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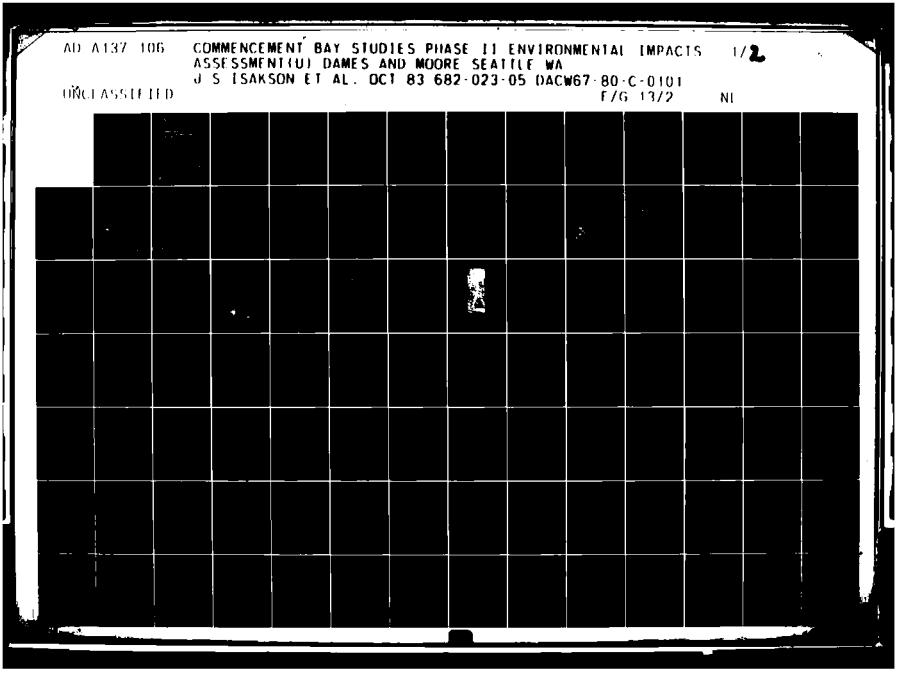

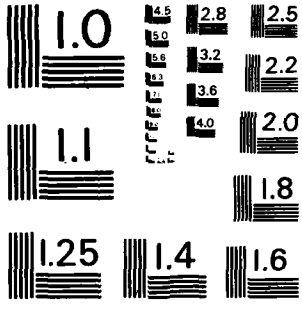

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COMMENCEMENT BAY STUDIES PHASE II, ENVIRONMENTAL IMPACTS ASSESSMENT

PREPARED BY:

DAMES AND MOORE

OCT. 1983

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Phase II of the Commencement Bay (Tacoma, Washington) Studies consists of project impact assessments (main body of text), Resource Information Synthesis (Appendix A), Ratings of Impact Significance (Appendix B), Methodology by Resource Area (Appendix C), and Projects Impacts Matrix (Appendix D).

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Salmonids	Wetlands	Aesthetics	City of Tacoma
Marine Fish	Sediments	Archaeology	Commencement Bay
Invertebrates	Birds	Historic Uses	Washington State
Physical Oceanography	Noise	Recreation	Impact Assessment
Water Quality	Land and Water Use	Port of Tacoma	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Dames and Moore assessed the environmental impacts associated with development of 37 projects planned or conceived for Commencement Bay study area. Elements of the natural and human environments assessed for each project included fish, invertebrates, birds, water quality, sediment quality, wetlands, land and water use, noise, and recreational, historic, archaeological, and aesthetic resources. Baseline data against which project impacts were assessed were developed from the COBS I effort and other studies performed in the study area.

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Commencement Bay Studies, Phase II

Environmental Impacts Assessment

Prepared For

Seattle District, U.S. Army Corps of Engineers
in accordance with
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October, 1983

Dames and Moore
Seattle, Washington 98125

DISCLAIMER

Data, Interpretations, and conclusions in this report are those of the authors.

PREFACE

The purpose of this study is to provide a qualitative assessment of impacts associated with 37 projects identified for development in the Commencement Bay study area based on supportable assumptions of project facilities and features. This study is to provide assessments of the level of impact imposed by each project on sensitive elements of the natural and human environment. However, detailed, quantitative assessment of project-generated impacts is not feasible due to uncertainties associated with project design and timing.

This study provides the U.S. Army Corps of Engineers, Seattle District, other reviewing and permitting agencies, local government, and permit applicants with a well-documented method of evaluating the level of project-generated impacts. The Corps recognizes and supports the need for full compliance of future projects with existing NEPA and/or SEPA requirements for impact assessment as well as continued project-by-project permit review of development proposed for the Commencement Bay study area. Therefore, the assessments herein are intended solely to convey a sense of relative importance among project-generated impacts and are not intended to be interpreted as findings or recommendations for future permitting action by the Corps or other permitting authority.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

STUDY BACKGROUND AND AUTHORIZATION

In March 1980, the U.S. Army Corps of Engineers, Seattle District (hereinafter referred to as "the Corps"), issued a contract for Baseline Studies and Evaluations for the Commencement Bay Study/Environmental Impact Assessment (COBS). This contract established the scope of services to be undertaken in completing environmental studies within Commencement Bay in Pierce County, Washington.

The study background, authority, and purpose and objectives from this contract are presented below:

> (Section) 1.1. Background. Commencement Bay has been the object of considerable industrial and commercial development activity over the past decades. The Port of Tacoma is a major port in western Washington and has a continued interest in development and expansion of port and harbor facilities in Commencement Bay and the waterways. Various industries are located in and around the bay, including shipbuilding, shipping, concrete products, storage facilities, and handling of ores, chemicals, metals, petroleum, timber, and other materials. There is significant pressure for continued development of the area, including new marinas and restaurants, expansion of existing industrial facilities, maintenance dredging and disposal of dredged material, fills, and construction of cargo handling facilities.
>
> Various local, state, and federal agencies with regulatory, planning, and/or resource management responsibilities in the Commencement Bay area have been concerned with future development plans, permit applications, and proposed projects in the bay. Meetings and discussions between the agencies were begun in November 1977 and continued through September of 1978. The result of these meetings was a consensus for a Commencement Bay Study/EIA which would generate new and detailed baseline data and would provide an assessment of plans, policies, projects, and activities in the Commencement Bay area.
>
> The information resulting from the Commencement Bay Study/EIA is intended to be used by federal and state agencies, the City of Tacoma, Port of Tacoma, Pierce County, the Puyallup Indian Nation, and all other interested groups and persons, to assess possible impacts of proposed development in the Commencement Bay area.
>
> (Section) 1.2 Study Authority. The Seattle District, U.S. Army Corps of Engineers, is engaged in the regulation of activities in or upon the waters of the United States and adjacent wetlands under provisions of Section 10 of the River and Harbor Act of 1899 (30 Stat. 1151; 33 U.S.C. 403) and Section 404 of the Clean Water Act. Within this area, permits for dredging, filling, moorage and other

activities must be obtained from the Seattle District, Corps of Engineers. As lead agency, the Seattle District will conduct COBS under the authorities of the Clean Water Act of 1977 (33 U.S.C. 1344) and the National Environmental Policy Act.

(Section) 1.3 Study Purpose and Objectives. The overall purpose of COBS is to provide baseline data and an environmental assesssment of proposed activities, projects, plans, and policies in the Commencement Bay area. The study must present the material in a format that both meets environmental impact assessment requirements and makes the data useful for assessment of future plans and projects. The objectives of COBS are:

a. to collect baseline data and provide a detailed description of the natural and human systems of the Commencement Bay area,

b. to present a method for evaluating the environmental impacts of proposed activities in any part of the study area, and

c. to assess and describe the environmental impacts of various projects and plans in the study area.

Publication of the seven-volume Commencement Bay Study (Dames & Moore 1981) completed Objective 1.3,a and the first phase of the study (COBS I). Baseline data were collected for the following general areas and are an integral part of the assessments contained herein:

- Fish
- Invertebrates
- Wetlands
- Water Quality
- Sediments
- Birds
- Air Quality and Climate
- Noise
- Aesthetics
- Land and Water Use
- Zoning, Land/Water Use Plans and Policies
- Water-Related Cultural Resources
- Physical Oceanography

Commencement Bay Study/Environmental Impact Assessment, the second phase of the study (COBS II) fulfills the requirements of Objectives 1.3,b and 1.3,c. The primary purpose of COBS II, as stated in the COBS II Work Plan, is to provide environmental evaluations of development of projects either currently proposed or likely to be implemented in the study area. Specific COBS II study effort objectives are to:

- Review and synthesize all pertinent resource information/data collected from Commencement Bay (sources to include COBS I information and recent information available from federal, state, local, and Indian Nation studies);

- Identify reasonably foreseeable development projects/scenarios in Commencement Bay;

- Conduct impact evaluations for proposed major development projects/ predicted development scenarios most likely to occur in the bay/ waterways, along the lower section of the Puyallup River, and along the Commencement Bay shorelines;

- For each impact evaluation, provide project description, important resources present, predictable environmental consequences, feasible/ logical mitigation measures, and any feasible alternatives; and

- Provide analyses of cumulative impacts likely to occur with each development scenario in each waterway/shoreline segment evaluated.

In addition, COBS II describes the methodology used in perf ing the impact evaluations.

Discussion with the Corps reduced and combined the resources ev ited in COBS I. The 10 resources evaluated in COBS II are:

- Fish and Invertebrates
- Birds
- Wetlands
- Water Quality and Sediments
- Noise
- Aesthetics
- Recreation
- Historical/Cultural/Archaeological
- Land Use
- Navigation/Water Uses

REPORT ORGANIZATION

The organization of this report conforms to the COBS II study objectives listed above. The Introduction, Chapter 1, establishes the history and authorization of the present study, COBS II, and its relationship to a prior study, COBS I. The purpose and study objectives as given in the COBS II Work Plan and the study area boundaries are described.

Chapter 2, Methodology, describes the methodology employed to assess the level of impact associated with identified project development in the COBS II study area. This section is supported by Appendix A, Resource Information Synthesis, which summarizes studies that present data relevant to COBS II analysis. The data in Appendix A are, for the most part, related to biological and chemical conditions in the study area and the characteristics of wastewater discharges to receiving waters. Data in these studies complement data presented in the COBS I baseline studies and support the identification of sensitive environmental areas in the COBS II study area. These sensitive areas were considered in evaluations of project impacts made in subsequent study efforts to determine the individual and, in some cases, cumulative impacts of projects planned or envisioned for the study area.

It should be emphasized that the methodology described in Chapter 2 simply provides a means for assessing the relative level of impacts imposed by identified projects. Many assumptions related to project design, timing, etc. were made to supplement project descriptions. The evaluations also do not reflect the application of available techniques for mitigating adverse effects; that is, the assessments reflect unmitigated impacts. Therefore, while the methodology may provide a

guide to assessing these and similar future projects by identifying areas of environmental concern, it is not intended to direct or reflect future permitting decisions by the Corps and other responsible federal, state, and local authority.

The second section of Chapter 2, Project/Scenario Identification, provides a description of six developmental subareas within the study area. These six subareas were considered in subsequent study efforts to determine the individual and cumulative impacts of new projects planned or envisioned for the subareas specifically and the study area in general.

The methodology employed to determine impacts of proposed major development projects/predicted development scenarios is discussed in the final section of Chapter 2, Evaluation Methodology. Further analysis of the methodology used is contained in Appendix B. Application of the methodology as it applied to each resource area is specified in Appendix C, while Appendix D provides an overview of the impact assessment ratings for all the individual projects.

Chapter 3, Existing Development, provides an overview of industrial and commercial development within the study area. Individual projects planned or envisioned for development within the study area are listed and discussed in general terms for each developmental subarea in Chapter 4, Projects Planned for Development Subareas.

A summary of impacts for general types of projects (e.g., marinas, shore treatment) and possible mitigation measures and alternatives are discussed in Chapter 5, General Project Types and Associated Impacts, Mitigation Measures, and Alternatives. Interaction of the generic projects and activities with the natural environment are examined first, with the human environment second. All of the projects evaluated are listed in Chapter 6, Specific Project Evaluations. The location, construction, and activities of each project are described and important resources are identified. The impact of the project on the natural and human environment is assessed, and appropriate mitigation measures and alternatives are identified. Finally, cumulative impacts of development of all the projects within a development subarea are discussed in Chapter 7, Full Subarea Development. Chapter 8, Full Study Area Development supplements this analysis with a projection of the possible conditions of the natural and human environments that might result from full development of the COBS II study area at some time in the future.

Published and unpublished information used in preparation of this report is contained in Chapter 9, References.

Detailed work sheets on each project used in preparing this report have been given to the Corps as an attachment. The quantity (1 worksheet for each resource area for each project; i.e., 10 x 37) precluded their inclusion with this report. However, the impact assessments are summarized in Table D-1 and the analyses are discussed on a project-by-project basis in Section 6.

STUDY AREA

Commencement Bay is a northwest-southeast trending marine body of water located near the southern end of the main basin of Puget Sound in northwest Washington State (Figure 1). The study area boundaries, as specifically determined through discussion with the Corps, include: (1) the harbor industrial area bounded by Commencement Bay and U.S. Highway 99 to include all waterways and creeks east to U.S. Highway 99 (see Figure 1); (2) the west side of City Waterway lands along the south and north shores of Commencement Bay (landward either 200 feet on a horizontal plane from the ordinary high watermark or from the ordinary high watermark to the base of the adjacent bluff, whichever distance is greater); and (3) the north shore of Commencement Bay immediately above the entrance to Hylebos Waterway.

The Central Business District of the City of Tacoma lies adjacent to the west shore of City Waterway. The Port of Tacoma and the associated port industrial area occupies the extensively filled and modified Puyallup delta at the eastern end of Commencement Bay. The north shore of the bay is dominated by residential areas of northeast Tacoma.

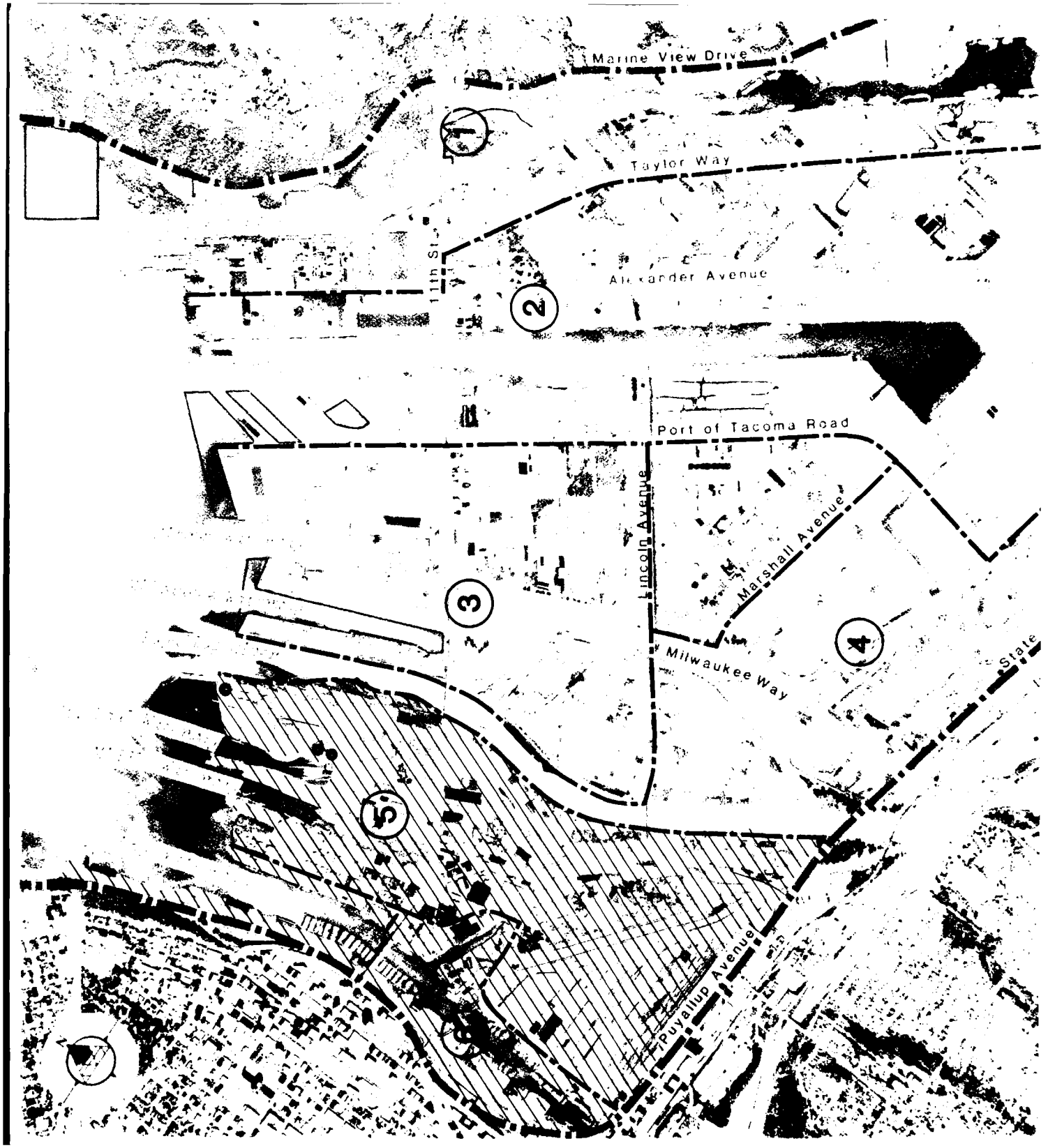
For purposes of this study, the COBS II study area consists of two portions of the COBS I study area, Parcels A and B. These parcels were further divided into six development subareas based upon the concentration of proposed projects and the orientation of existing uses along existing waterways. Further discussion of the development of the six subareas is found in Chapter 2.

The six development subareas, established for the purpose of COBS II analyses, are:

1. Hylebos Waterway
2. Blair Waterway
3. Sitcum/Milwaukee Waterways
4. Port Industrial Flats*
5. St. Paul/Middle Waterways
6. City Waterway

The subareas are depicted in Figure 1.

*The term "Port Industrial Flats" is merely a subarea description, and is not intended to infer control or responsibility by the Port of Tacoma as a municipal entity.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Taylor Way
11th St
Alexander Avenue
Port of Tacoma Road
Lincoln Avenue
Marshall Avenue
Milwaukee Way
State
Puyallup Avenue
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3
4
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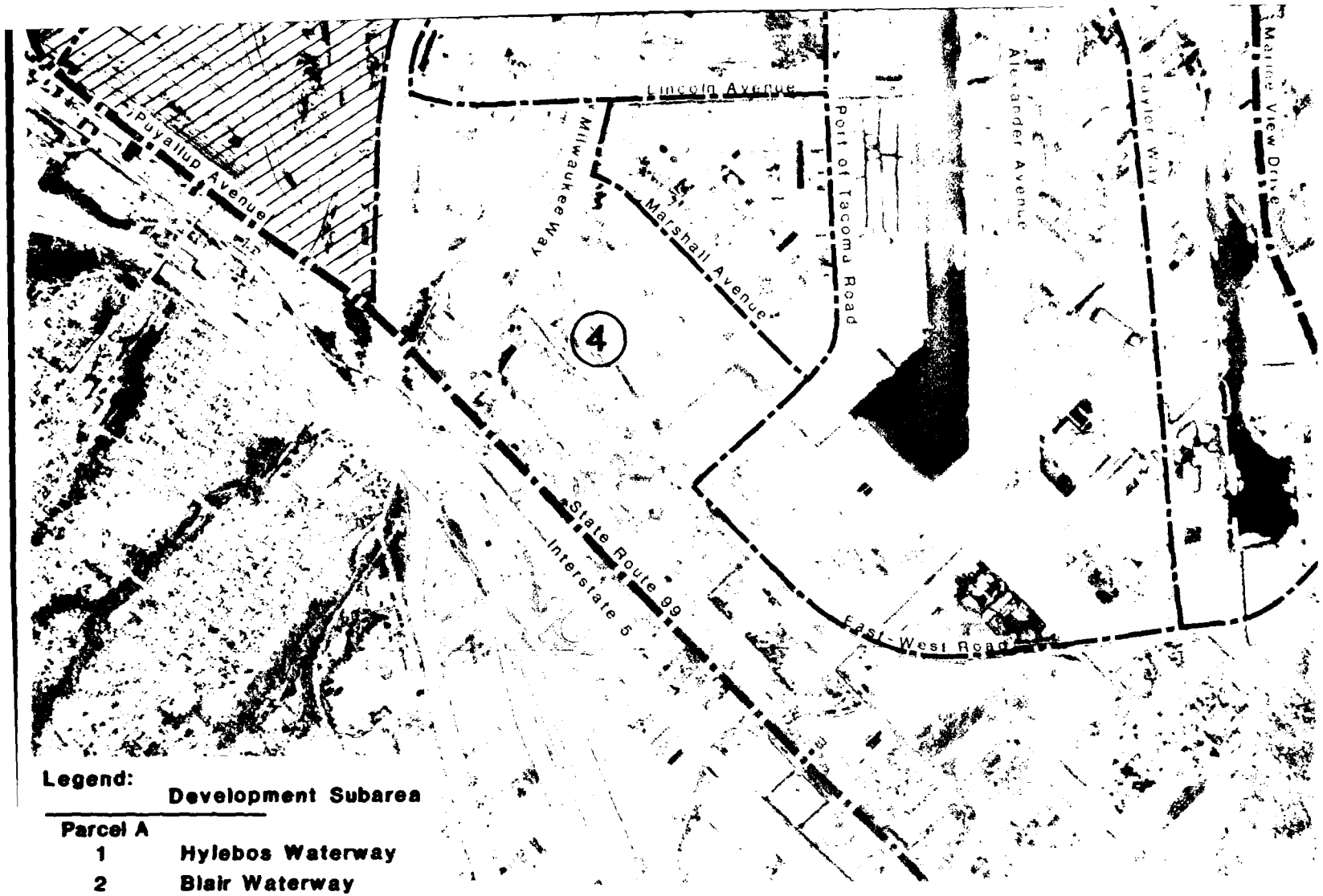


Legend:

Development Subarea

Parcel A

1	Hylebos Waterway
2	Blair Waterway
3	Sitcum/Milwaukee Waterways
4	Port Industrial Flats

Parcel B

5	St. Paul/Middle Waterways
6	City Waterway
	Study Area Boundary
	Subarea Boundaries

0 1/2 1

Nautical Miles

Location Map

Study Area

Study Area Including Parcel Designations and Development Subareas

2. METHODOLOGY

RESOURCE INFORMATION SYNTHESIS

Brief summaries of the most recent information available from environmental studies performed in the study area (other than the COBS I Baseline Studies) are contained in Appendix A. As noted in some cases, the completion of the COBS II effort occurred before results of several other relevant studies became available. The contractual cutoff for this information synthesis was January 1, 1983; however, some ongoing 1983 activities are discussed for the sake of continuity and completeness. An attempt was made to obtain preliminary results where possible from agencies conducting the studies (NOAA-MESA, DOE, EPA, among others); however, due to the nature and progress of the studies being performed, such data were not always available at the time of this writing. Potential data input deficiencies are also indicated in the appendix summaries.

PROJECT/SCENARIO IDENTIFICATION

Analysis of projects planned or envisioned for the study area indicates that future development is concentrated in six distinct subareas. The six subareas were identified after projects planned or envisioned were mapped on a relatively large-scale map (1:15,000). Groups of projects corresponding to each of the development subareas were readily identifiable. The development subarea concept was reinforced by the functional integrity of each of the subareas.

In most cases, this functional integrity results from orientation of similar uses either in scale or function along a given waterway or series of adjacent waterways, resulting in cumulative impacts on water quality, sediments, and marine transportation within these systems. These impacts would then influence the distribution and abundance of biota. The types of uses within each developmental subarea vary with and determine the character of waterway usage; most such uses are water-dependent. The one subarea that is not oriented around a waterway (Port Industrial Flats) is being developed primarily with medium-scale (2- to 10 acre) uses that are primarily dependent on land transport, such as warehousing and distribution uses.

Projects proposed for development within each of these distinct subareas are, for the most part, similar. However, since development associated with each subarea is dependent upon the present and planned use of the subarea, development scenarios for each distinct subarea may differ substantially from those in other subareas.

EVALUATION METHODOLOGY

Overview

This study required evaluation of 37 projects proposed or identified for development in Commencement Bay in terms of a set of environmental issues relevant to the Corps' permitting and review responsibilities. These environmental evaluations were required both for individual

projects and for cumulative development scenarios. The methodology developed for conducting the project impact evaluations is described in this section of the report; it reflects both the study goals and the limitations in scope and available information. This methodology is readily applicable to any additional projects that may be identified in the future.

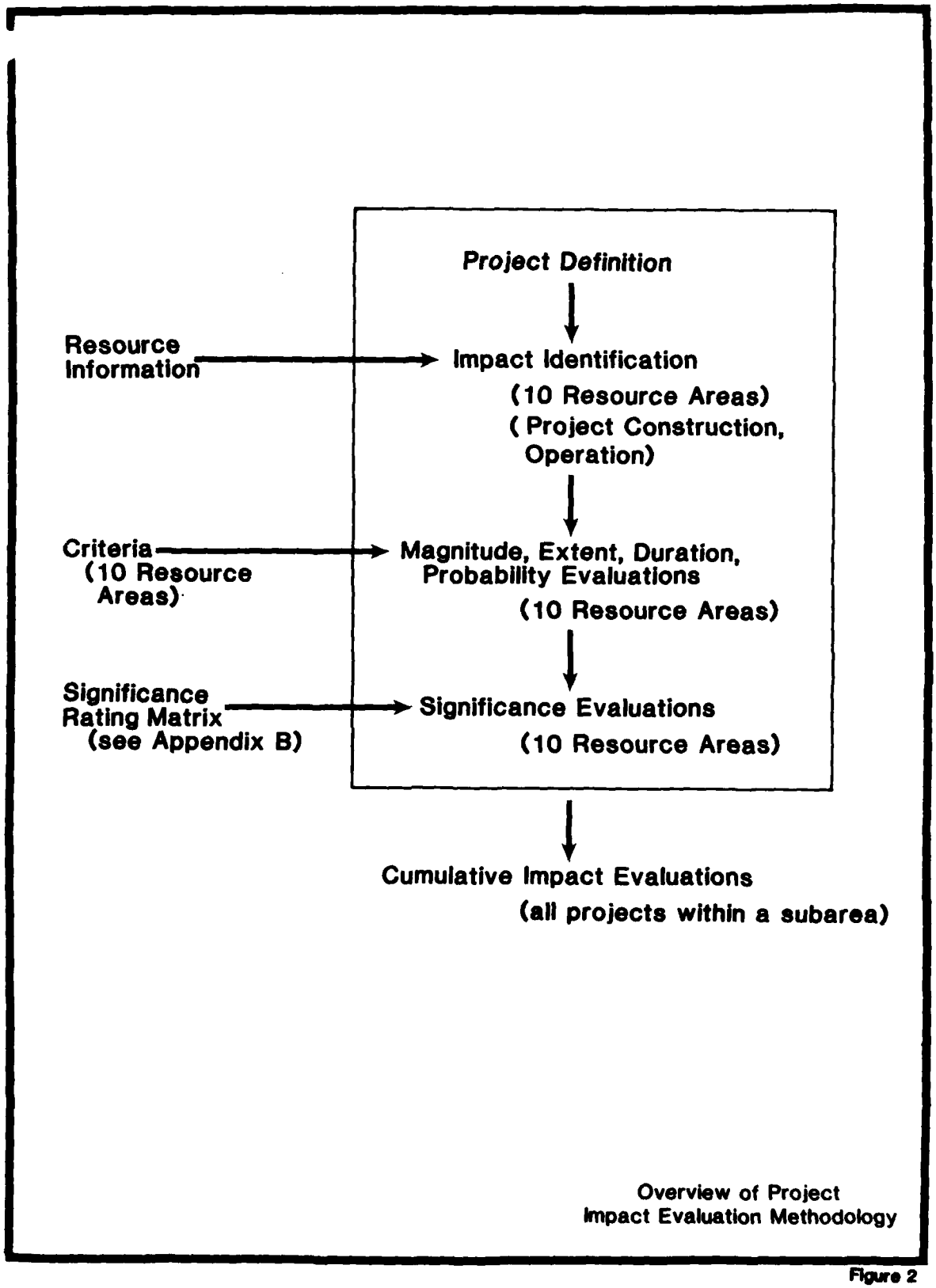
Three primary purposes are served by the evaluation methodology. First, it provides documentation of the judgments made of potential project impacts. Second, it allows comparative assessments of impacts both within and between the identified projects. Third, it highlights those potential project impacts that are key concerns for each project that should be focused on during project review by the Corps.

An overview of the project impact evaluation methodology is presented in Figure 2. A project definition for each of the identified projects was developed from Corps permit applications and other available information. This project definition included information on construction requirements, physical modifications and structures required, operating scenarios, and similar project characteristics. Based on the Commencement Bay resource information developed in COBS I (Dames & Moore 1981) or available in other recent literature (see Appendix A), the potential environmental impacts in each of 10 defined resource areas* were identified for each project. Impact identification was carried out separately for the construction and operation phases of each project. Each identified impact was evaluated with respect to four component characteristics: Magnitude, Extent, Duration, and Probability of occurrence. Finally, the four component characteristics for each impact were combined into a single rating of significance for construction and a single rating for operation in accordance with an overall significance rating matrix (see Appendix B). As indicated in Figure 2, after this process was completed for all projects individually, the impacts resulting from the cumulative development of projects within subareas of Commencement Bay were evaluated.

Project Evaluations

The environmental impacts of any project depend on both the nature of that project and the setting in which it occurs. The activities associated with project construction and operation (and the physical changes resulting from the project) need to be evaluated in light of the existing resources (onsite and offsite) that could be affected. The evaluations of potential project impacts for this study adopted this perspective and considered the cause/effect relationships for direct and indirect effects. Impacts were identified based on the project as defined, without additional migitation efforts; mitigation possibilities were then considered separately. Available information was used in developing project descriptions. Projects differed markedly in the amount and detail of information available; some future development

*Fish/invertebrates, birds/terrestrial biology, wetlands, water quality/sediments, noise, recreation, historical/cultural/archaeological, land use, navigation/water use.



Overview of Project Impact Evaluation Methodology

Figure 2

projects did not have Corps permit applications or other basic information available and required assumptions to be made even for basic project description. Where required, such assumptions are documented. The information on resources that could be affected by a project was compiled from the COBS I resource inventories and other available studies. The sources of these data and any assumptions regarding the resource information were also documented for each impact evaluation.

Projects involving similar construction activities (e.g., dredging and filling) or similar land and water uses (e.g., marinas) normally have a common set of potential impacts of particular concern, even though these impacts must then be evaluated with respect to the particular project setting. The set of 37 projects evaluated in this study contains numerous subsets of projects with such similarities. Therefore, as a first step in project evaluations, an assessment of the general impacts of common project activities and project types was conducted (see Chapter 5). This analysis of general project impacts avoided unnecessary repetition and provided a frame of reference for the individual project evaluations that follow (Chapter 6).

The identification of project impacts proceeded by definition of sub-issues within each resource area, consideration of interactions among the resource areas, and the analysis of direct/indirect and onsite/offsite impacts. In some cases, a resource area was not relevant for a given project and was so noted. Each identified impact was then evaluated on the four component characteristics (magnitude, extent, duration, and probability of occurrence). Although each of these four components is a continuum, for this study three discrete levels for each component were used to assess impacts. These three levels were defined by criteria established by the principal investigators for each resource area, so that identified project impacts could be characterized on each of the four impact components. These criteria for each resource area are provided in Appendix C. Project impacts for this study are thus represented by a set of four scores denoting assessments of impact magnitude, extent, duration, and probability.

Significance Ratings

In addition to listing and describing specific potential project impacts, an overall assessment of the significance or importance of impacts was required. Significance (not used in the statistical sense) may be represented by a continuum of values on a one-dimensional (composite) scale, corresponding to the general perception that, all things considered, impacts to different resources can be ranked as more or less significant. Such an ordinal scale provides a direct means of comparing impacts, but it remains essentially judgmental. It does not provide a calculus for computing meaningful significance scores. The methodology developed for this study used a composite significance scale and includes extensive documentation to support conclusions on impact significance.

Somewhat arbitrarily, five points on a significance scale were identified and used in this study. These five significance levels form the hierarchic set used in classifying project impacts. The descriptive labels used for these significance levels were Severe, Considerable, Moderate, Minimal, and Inconsequential. While these labels should convey a sense

of relative position on the significance scale, it is stressed that they are not meant to do more than that; in particular (as discussed in the Preface) they should not be interpreted as findings or recommendations for future permitting actions by the Corps, or other permitting authority.

The method of deriving significance levels for impacts is discussed in detail in Appendix B. The significance ratings were determined by the evaluations of impact magnitude, extent, duration, and probability of occurrence (see Figure 2). Since each of these four impact components was assigned on one of three values, a total of 81 (3^4) combinations was possible. A significance rating matrix (Appendix B) was developed for this study which identifies one of the five significance levels for each of the 81 possible combinations. Thus, the significance ratings are a condensation of the more detailed information developed for each impact. The analyses provided in Appendix B demonstrate that this condensation was consistent (e.g., as the magnitude, extent, duration, and probability of impacts decrease, so does the significance rating) and that probability and magnitude had a greater effect on significance ratings than extent and duration.

A summary of the impact evaluations for all 37 projects is provided in Appendix D. This summary matrix includes, for each project, impact evaluations for both project construction and operation in each of 10 resource areas. These 20 impact evaluations for each project give the significance rating and the underlying assessments of impact magnitude, extent, duration, and probability.

Cumulative Impact Evaluations

Evaluations of projected cumulative impacts were performed assuming construction and completion of all projects identified for each Commencement Bay subarea. No specific phasing of projects was assumed for the cumulative impact evaluations. It is recognized that the order and timing of project developments can affect resulting environmental impacts, either increasing or decreasing them; however, the large number of possible phasing scenarios introduces complexity beyond the scope of this study.

Two data summaries were used in the cumulative impact evaluations. The impact evaluations for individual projects are summarized in Appendix D, which provides an overview of individual assigned impact level and significance for each of the projects within each subarea. A separate cumulative description of project physical characteristics (e.g., dredging, filling, shoreline treatment) was developed for each subarea with reference to the total available subarea resources (see Tables 2 through 6 in Chapter 7). This summary allowed identification of the total project use and commitment of subarea resources of concern.

The cumulative impact evaluations, using these two data summaries, focused on the identification of three major areas: the comparison of cumulative impacts to the existing subarea resources; identification of resource areas where impacts could be more than incremental and additive; and conflicts between projects, especially any instances where projects were deemed mutually exclusive.

3. EXISTING DEVELOPMENT

INTRODUCTION

Industrial uses dominate the Hylebos, Blair, Sitcum/Milwaukee waterways and the Port Industrial Flats development subareas. Major existing uses in the study area are shown in Figure 3. The Port of Tacoma currently owns 1,587 acres of the land and 384 acres of the water. The port leases 1,063 acres of its lands and waters; 908 acres are vacant. Port-owned land is located primarily along Blair, Sitcum, and Milwaukee waterways and in landward areas to the south that are oriented around East-West Road and its intersection with Milwaukee Way.

Privately owned land is, for the most part, located along Hylebos Waterway and the central portions of the port industrial area. Public (port-owned) and private industrial uses located along the industrial waterways are primarily water-oriented.

GENERAL

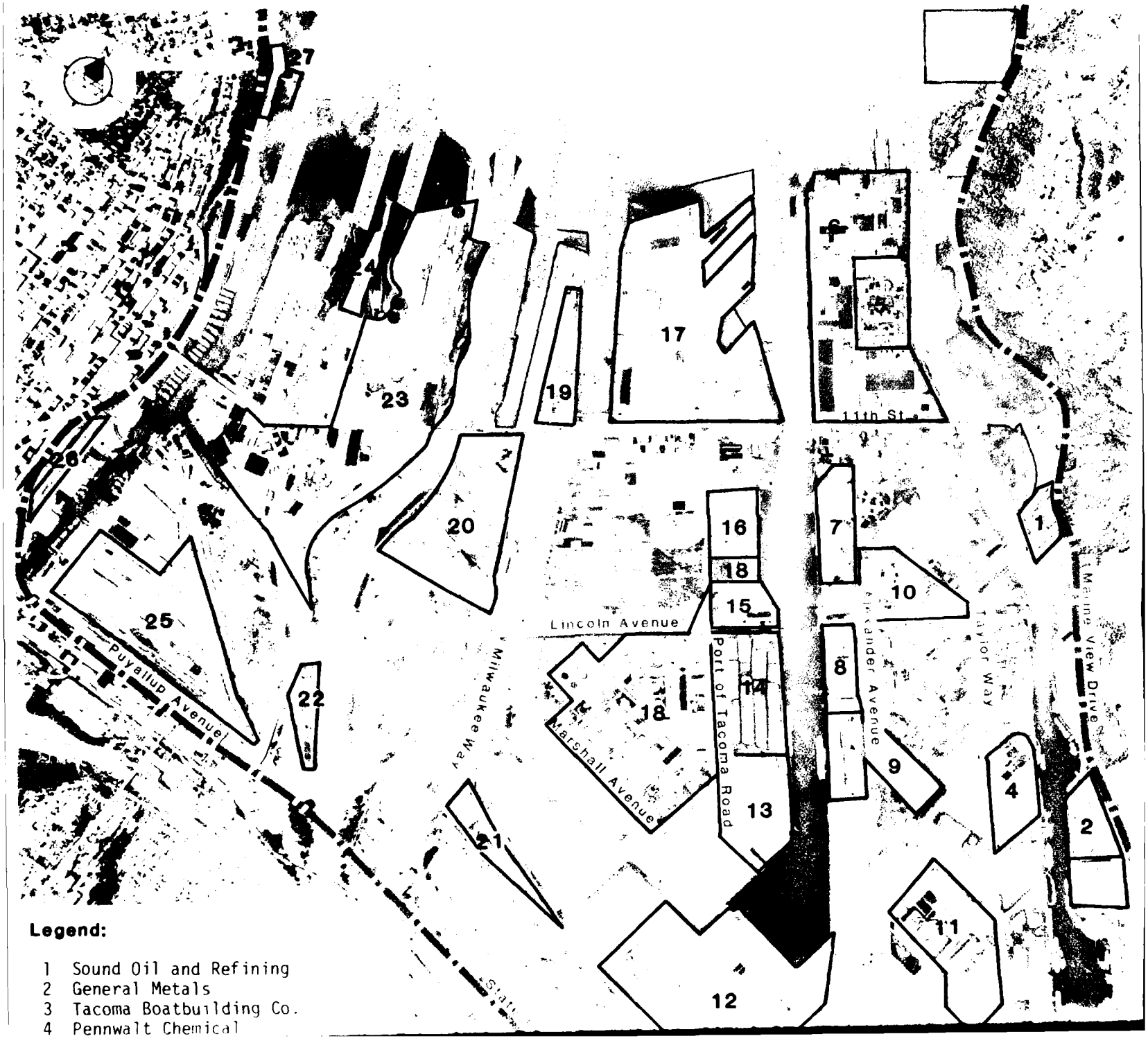
Lands adjacent to Hylebos Waterway are highly developed; vacant land available for filling is scarce. Conversely, a substantial amount of vacant land still remains along Blair Waterway, due to its more recent development. Most of the sizable vacant parcels are located along the north shore of the waterway. A substantial amount of vacant land remains landward of the industrial waterways as well, with the largest parcels located between Marshall Avenue and U.S. Route 99. Most of the vacant lands are owned or claimed* by the Port of Tacoma.

Uses in the St. Paul/Middle waterways and City Waterway subareas are characterized by a mix of industrial and commercial water-dependent uses. These lands generally are privately owned, and vacant lands are relatively scarce. The potential for redevelopment of previously developed lands is relatively high, particularly along City Waterway. The northeast shore of the lower Puyallup River is included in the Sitcum/Milwaukee waterways subarea. The southwest shore of the lower Puyallup River is included in the St. Paul/Middle waterways subarea.

HYLEBOS WATERWAY

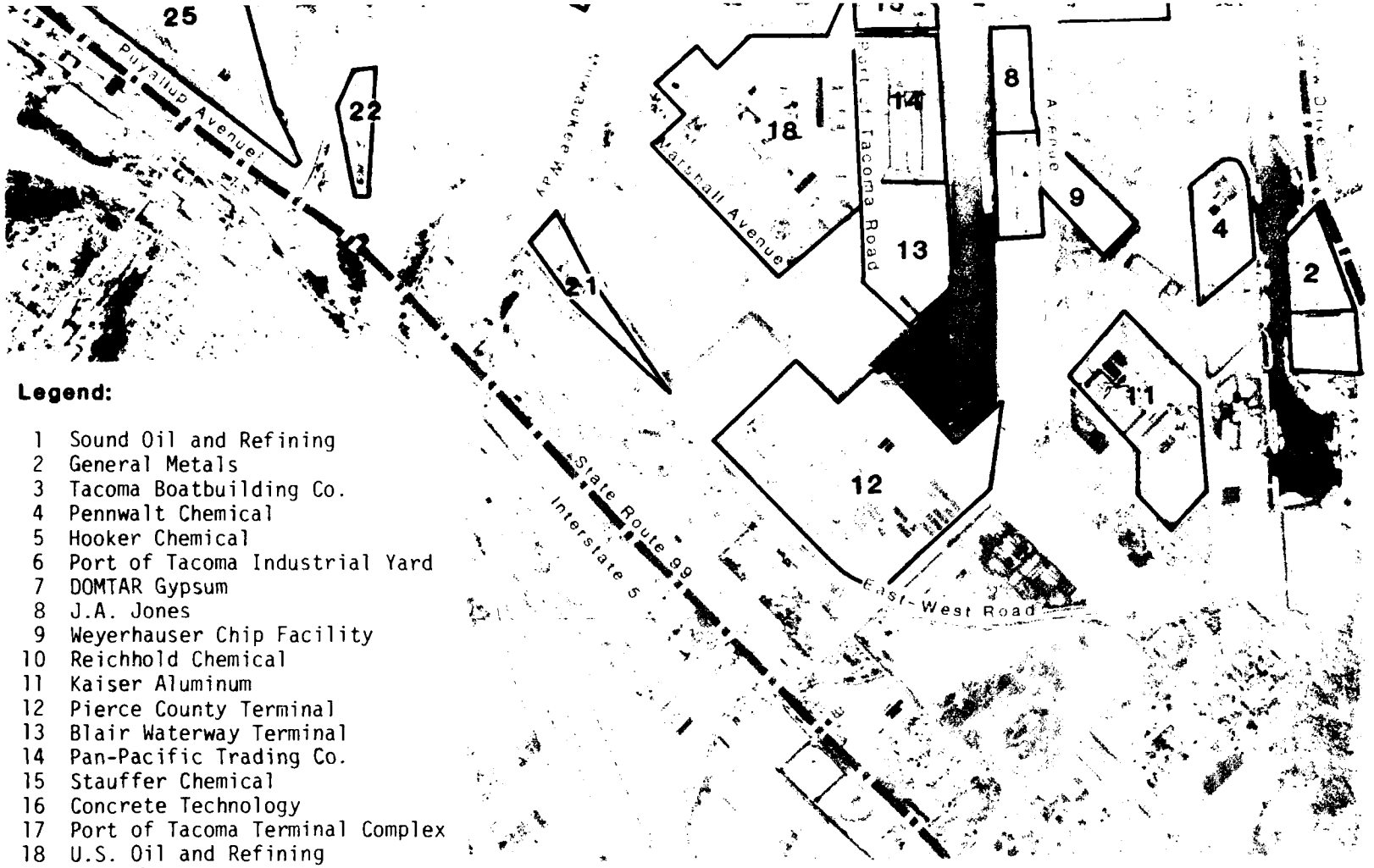
The Hylebos Waterway development subarea includes Hylebos Waterway proper and lands oriented around the waterway (see Figure 1). The subarea is bounded by the steep slopes along the north and northeast side of Marine View Drive, East-West Road to the east and southeast, and by Taylor Way (south of 11th Street) and Alexander Avenue (north of 11th Street) to the south and southwest. This subarea extends approximately 300 yards northwest of the waterway entrance along the north shore of Commencement Bay to include the site of a proposed marina (see Subarea 1 on Figure 1).

*The ownership of some land in the COBS study area by the Port of Tacoma is disputed by the Puyallup Tribe, which contends that some port-claimed lands were ceded to the tribe under the Medicine Creek Treaty of 1853.



Legend:

1 Sound Oil and Refining
2 General Metals
3 Tacoma Boatbuilding Co.
4 Pennwalt Chemical



Legend:

1 Sound Oil and Refining
2 General Metals
3 Tacoma Boatbuilding Co.
4 Pennwalt Chemical
5 Hooker Chemical
6 Port of Tacoma Industrial Yard
7 DOMTAR Gypsum
8 J.A. Jones
9 Weyerhauser Chip Facility
10 Reichhold Chemical
11 Kaiser Aluminum
12 Pierce County Terminal
13 Blair Waterway Terminal
14 Pan-Pacific Trading Co.
15 Stauffer Chemical
16 Concrete Technology
17 Port of Tacoma Terminal Complex
18 U.S. Oil and Refining
19 Alaska Terminal
20 Cascade Pole
21 Municipal Bolt Line Railyard
22 City S.T.P. 1
23 St. Regis Paper Co.
24 Payport Mills
25 Burlington Northern Railyard
26 Union Station
27 Port of Tacoma Grain Terminal

Study Area Boundary

Major Existing Uses in the Study Area

Current January 1, 1983

Development in this subarea is intensive, with few vacant lands remaining. Any substantial intensification of development or changes in industrial uses along Hylebos Waterway will occur through redevelopment of existing uses rather than infilling of undeveloped lands.

The southwest shore of outer Hylebos Waterway (seaward of the E. 11th Street Bridge) is highly developed with water-oriented industrial uses, including the Port of Tacoma Industrial Yard, which consists of ship repair and building facilities and various marine support uses. The Hooker Chemical Company operates a major chlorine production plant adjacent to the Port of Tacoma Industrial Yard. The opposing (northeast) shore is less intensely developed; two marinas and a large undeveloped tract used primarily for log storage dominate this shoreline segment.

The middle and inner shorelines of Hylebos Waterway are highly developed with water-oriented and, in many cases, long-standing industrial uses. Such uses include Sound Refining (a petroleum products refining and storage complex), a chemical plant operated by the Pennwalt Corporation, the main plant of the Tacoma Boatbuilding Company, General Metals of Tacoma (a scrap metal conversion facility), and several log storage and sort yards oriented around the turning basin.

BLAIR WATERWAY

The Blair Waterway subarea includes Blair Waterway proper and surrounding lands. The northeast boundary of the subarea (formed by Alexander Avenue, E. 11th Street, and Taylor Way) is the same as the southwestern boundary of the Hylebos Waterway subarea. The subarea is also generally bounded by East-West Road to the south and southeast and Port of Tacoma Road to the west and southwest; however, the central portion of the western boundary has been adjusted to include the primary U.S. Oil and Refining facility since this facility has associated distribution activity on the southwest shore of Blair Waterway (see Subarea 2 on Figure 1).

Both shorelines of outer Blair Waterway (seaward of the E. 11th Street Bridge) are heavily industrialized. The Port of Tacoma Industrial Yard (see description above) and Hooker Chemical dominate the peninsula between outer Hylebos and outer Blair waterways. On the peninsula separating Blair and Sitcum waterways, the Port of Tacoma operates a terminal complex of water-dependent uses such as cargo handling facilities, a grain terminal, alumina handling and storage facility, warehousing uses, and a marina.

The southwest shore of middle and inner Blair Waterway (between the E. 11th Street Bridge and the Blair turning basin) is intensively developed with large-scale, water-oriented industrial uses, including Concrete Technology, U.S. Oil and Refining, Stauffer Chemical, Pan Pacific Trading Corporation (log/wood product export), and the Port of Tacoma's Blair Waterway Terminal.

The north shore of middle and inner Blair Waterway is not as extensively developed as the opposing shore; however, a slow infilling by relatively large-scale industrial development is occurring, including a Weyerhaeuser

chip facility and a large construction complex operated by J.A. Jones, and the new DOMTAR Gypsum facility. The Port of Tacoma's multiple-use Pierce County Terminal is located on the turning basin at the landward end of Blair Waterway.

The area between Blair and Hylebos waterways (bounded by Alexander and Lincoln avenues and Taylor Way) is also partially developed, with large-scale industrial uses (such as Kaiser Aluminum and Reichhold Chemical) interspersed with large vacant tracts with good access to land transportation systems.

SITCUM/MILWAUKEE WATERWAYS

The Sitcum/Milwaukee waterways subarea includes the two waterways proper and the area bounded by Port of Tacoma Road on the north and northeast, Lincoln Avenue on the south and southeast, and the Puyallup River on the west and southwest (see Subarea 3 on Figure 1).

This subarea consists of two distinct use areas: (1) the waterways proper, which are characterized by various degrees of development ranging from intensive (along the northeast shoreline of Sitcum Waterway) to vacant (along both shorelines of Milwaukee Waterway); and (2) the landward area between E. 11th Street and Lincoln Avenue which supports relatively intensive nonwater-oriented industrial and commercial development.

Major development in this subarea includes the port terminals located on the peninsula between Sitcum and Blair waterways (see description under Blair Waterway subarea above), the Alaska Terminal on the opposing (southwest) shore of Sitcum Waterway, Cascade Pole (wood products manufacturing and storage) and Chicago Bridge & Iron located between the head of Milwaukee Waterway and Lincoln Avenue, and a complex of industrial warehousing and manufacturing uses bounded by Milwaukee Way, Lincoln Avenue, Port of Tacoma Road, and E. 11th Street.

Large areas of undeveloped land are present within this subarea. These vacant areas include much of the peninsula between Milwaukee and Sitcum waterways, the peninsula between Milwaukee Waterway and the Puyallup River, a large tract located southeast of E. 11th Street (formerly the Milwaukee Road rail yards), and other smaller scale developable tracts interspersed among mixed uses south of E. 11th Street.

PORT INDUSTRIAL FLATS

The Port Industrial Flats subarea comprises those portions of the study area not included under the other development subareas. This subarea is bounded by the Puyallup River on the west, State Route 99 on the south, and Hylebos Creek on the southeast. The landward boundary of the Hylebos, Blair, and Milwaukee/Sitcum subareas comprise the north boundary of the Port Industrial Flats subarea (see Subarea 4 on Figure 1).

This subarea is characterized by a moderate level of development, with large-scale intensive development interspersed with large tracts of

vacant land. All areas, regardless of associated development, have access to rail and highway transportation systems.

Major industrial development in this subarea includes the U.S. Oil and Refining complex occupying a large tract bounded by Lincoln Avenue, Port of Tacoma Road, and Marshall Avenue, the Municipal Belt Line railyard located just north of the East-West Throughway near its intersection with Milwaukee Way, and a major auto wrecking yard and steel and salvage yard just south of the intersection of Milwaukee Way and Lincoln Avenue.

Substantial mixed commercial and light industrial uses have developed along Pacific Highway (State Route 99) between the Puyallup River and the intersection of Pacific Highway and 54th Avenue (extended). These uses are dependent on excellent access to local and interstate road systems.

Several large tracts of vacant land are located in this subarea, with the largest oriented around the intersection of the East-West Throughway with Milwaukee Way in the western portion of the subarea, and with Marshall Avenue in the eastern portion of the subarea. All vacant tracts are served by existing local roadway systems linking with Interstate-5 (I-5) to the south. Several of the vacant parcels are currently served by rail; all tracts are near existing rail lines, which could be extended to serve the tracts during development.

ST. PAUL/MIDDLE WATERWAYS

The St. Paul/Middle waterways subarea consists of St. Paul and Middle waterways proper and lands oriented around the two waterways (see Subarea 5 on Figure 1). Subarea boundaries include the Puyallup River to the east and northeast and Puyallup/Pacific avenues (State Route 99) to the south and southeast. The western boundary of this subarea is represented by a line running 200 feet east of, and parallel to, the east shore of City Waterway from the mouth of City Waterway on the north to Puyallup/Pacific avenues on the south (see Subarea 5 on Figure 1).

This subarea is heavily industrialized throughout. The St. Regis Paper Company occupies the peninsula between St. Paul Waterway and the Puyallup River and the area landward to E. 11th Street. Paxport Mills occupies the peninsula between Middle and St. Paul waterways.

Development to the southeast of E. 11th Street includes a variety of medium-scale industrial uses and the main Burlington Northern railway yard serving the greater Tacoma area. The City of Tacoma operates a sewage treatment plant on the Puyallup River just south of the 21st Street (Lincoln Avenue) Bridge. Vacant lands in this subarea are relatively scarce and isolated, with the largest parcels located along the Puyallup River near the I-5 and Pacific Avenue (State Route 99) bridges.

CITY WATERWAY

The City Waterway subarea includes City Waterway proper and adjacent lands (see Subarea 6 on Figure 1). The eastern boundary of this subarea is the same as the western boundary of the St. Paul/Middle waterways subarea. The subarea is bounded on the south by Pacific Avenue and on the west by a line running 200 feet west of, and parallel to, the west shore of City Waterway from the Port of Tacoma Grain Terminal on the north (located outside the mouth of the waterway) to Pacific Avenue on the south.

The City Waterway subarea is intensively developed with commercial and small-scale industrial uses. Several marinas are located in the waterway, with a total capacity of approximately 700 moorages.

Development on the west side of the waterway includes the Continental Grain Terminal on Schuster Parkway northwest of the waterway mouth, freight forwarding and storage uses north of the E. 11th Street Bridge, and mixed water-oriented industrial, commercial, and institutional uses (including small manufacturing firms, distribution centers, and marinas) south of the bridge. Union Station, an abandoned but restorable turn-of-the-century rail passenger terminal, is located in the 1800 block of Pacific Avenue near the west boundary of the study area. On the east shore, the area from the mouth of the waterway to the E. 11th Street Bridge is dominated by petroleum products storage and distribution uses and small manufacturing plants. South of the bridge, larger-scale manufacturing and distribution uses are dominant, due to the proximity of both City Waterway (providing water transport capability) and the Burlington Northern railway yard.

Vacant land available for development is scarce. Future development in the City Waterway subarea will result primarily from redevelopment of existing uses.

4. PROJECTS PLANNED FOR DEVELOPMENT SUBAREAS

INTRODUCTION

This section presents data on individual projects planned or envisioned for development in each of the identified development subareas. No attempt has been made in this chapter to assess impacts associated with such projects, whether considered individually or in combination.

The projects identified below have been identified through contacts with agency personnel, notably Corps, the Port of Tacoma, the City of Tacoma, and private industry sources. Permits have been granted for many of these projects; it is likely that work has already commenced on several.

Perhaps the most significant projects (or combination of projects) proposed for development in the study area are: (1) the substantial expansion of the Port of Tacoma's cargo handling capabilities and facilities under their comprehensive development plan (TAMS 1982); (2) the dredging of Blair and Sitcum waterways to provide greater underkeel channel depth; and (3) the stated intent of the City of Tacoma to encourage the development of new, and continuation of existing, "people/park/commercial [water-dependent and] water-related uses" in the City Waterway subarea (Tacoma Planning Department 1974). The intent will be reinforced in a new, greater central business district plan now in preparation by the Tacoma City Planning Department.

These and other projects illustrate the broad development scenarios for the subareas through the year 2000. The Port Industrial Area* (consisting of Hylebos, Blair, Sitcum, and Milwaukee waterways and the port industrial lands between the waterways and State Route 99) is planned for and will continue to develop as an industrial areas. Substantial dredging and filling, which in the past has created the present configuration of lands and waterways, is anticipated to occur in the Port Industrial Area in support of industrial development. The west shore of City Waterway and the east shore south of E. 15th Street are expected to slowly evolve from their current mixed-use character to one of human-oriented uses. The east shore of City Waterway north of E. 15th Street is planned for and will continue to support industrial uses. The St. Paul/Middle waterways subarea will also continue to support primarily industrial uses; however, its mixed-use character will continue.

SUBAREA 1 - HYLEBOS WATERWAY

Projects planned for the Hylebos Waterway development subarea through the year 2000 are listed in Table 1 and depicted on Figure 4. For the most part, these projects represent small-scale wharf and dock facility improvements including associated filling, piledriving, and decking. Two large-scale projects have been identified for development in the Hylebos subarea--a proposed marina outside of the waterway itself and a planned

*The term Port Industrial Area is not intended to convey any direct connection with the Port of Tacoma as a municipal entity.

TABLE 1

PROJECTS PLANNED IN THE STUDY AREA

Subarea		Project Name	Sponsor
1. Hylebos Waterway	1.	Hylebos Marina	J.E. Meaker
	2.	Sound Refining Pier Expansion	Sound Refining
	3.	Johnson Dock	C.D. Johnson
	4.	Marine Technical Services Pier and Warehouses	Marine Technical Services
	5.	Louisiana-Pacific Log Handling Facility	Louisiana-Pacific
	6.	Hooker Chemical Modernization	Hooker Chemical
	7.	Blair Waterway Dredging and Bridge Replacement	Port of Tacoma
2. Blair Waterway	8.	TOTE Relocation and Finger Piers	Port of Tacoma
	9.	Pierce County Terminal Berth	Port of Tacoma
	10.	Pierce County Terminal Berth A and B Extension	Port of Tacoma
	11.	Fife Storm Drain and Outfall	City of Fife
	12.	Concrete Technology Dredging	Concrete Technology
	13.	Port of Tacoma Terminal 4 Expansion and Dredging	Port of Tacoma
	14.	Port of Tacoma Slip 2 Fill	Port of Tacoma
	15.	Port of Tacoma Piers 1 and 2 Retirement and Slip 1 Fill	Port of Tacoma
	16.	Port of Tacoma Pier 5 Fill	Port of Tacoma
3. Sitcum/ Milwaukee Waterways	17.	Port of Tacoma Berth D, Terminal 7 Extension	Port of Tacoma
	18.	Sitcum Waterway Shoal Dredging	Port of Tacoma
	19.	Sitcum Waterway Dredging	Port of Tacoma
	20.	Port of Tacoma Wharf	Port of Tacoma
	21.	Milwaukee Waterway Fill	Port of Tacoma
	22.	Milwaukee Waterway Railroad Yard Paving	Port of Tacoma
	23.	Port of Tacoma Parcel 5 Fill	Port of Tacoma
5. St. Paul/ Middle Waterways	24.	Puyallup River Training Wall Maintenance	U.S. Army Corps of Engineers
	25.	Paxport Mills Bulkhead	Paxport Mills
	26.	Pacific Yacht Basin Repair Yard	Pacific Yacht Basin
	27.	Foss Tug Float	Foss Launch & Tug
	28.	Superior Oil Dock and Dredging	Superior Oil
6. City Waterway	29.	Globe Machine Ramp and Float	Globe Marine
	30.	City Marina Expansion	Marshall Perrow
	31.	Dillingham Site Marina Expansion	J.E. Meaker
	32.	Pick's Cove Covered Moorage	Pickering Industries
	33.	Dock Street Connector	City of Tacoma
	34.	City Waterway Marina Expansion	Morris & Sons
	35.	Union Depot Redevelopment	Glacier Park Corp./ Cornerstone
	36.	Tacoma Marina and Breakwater	Glacier Park Corp.
	37.	Navigation Channel Realignment	City of Tacoma

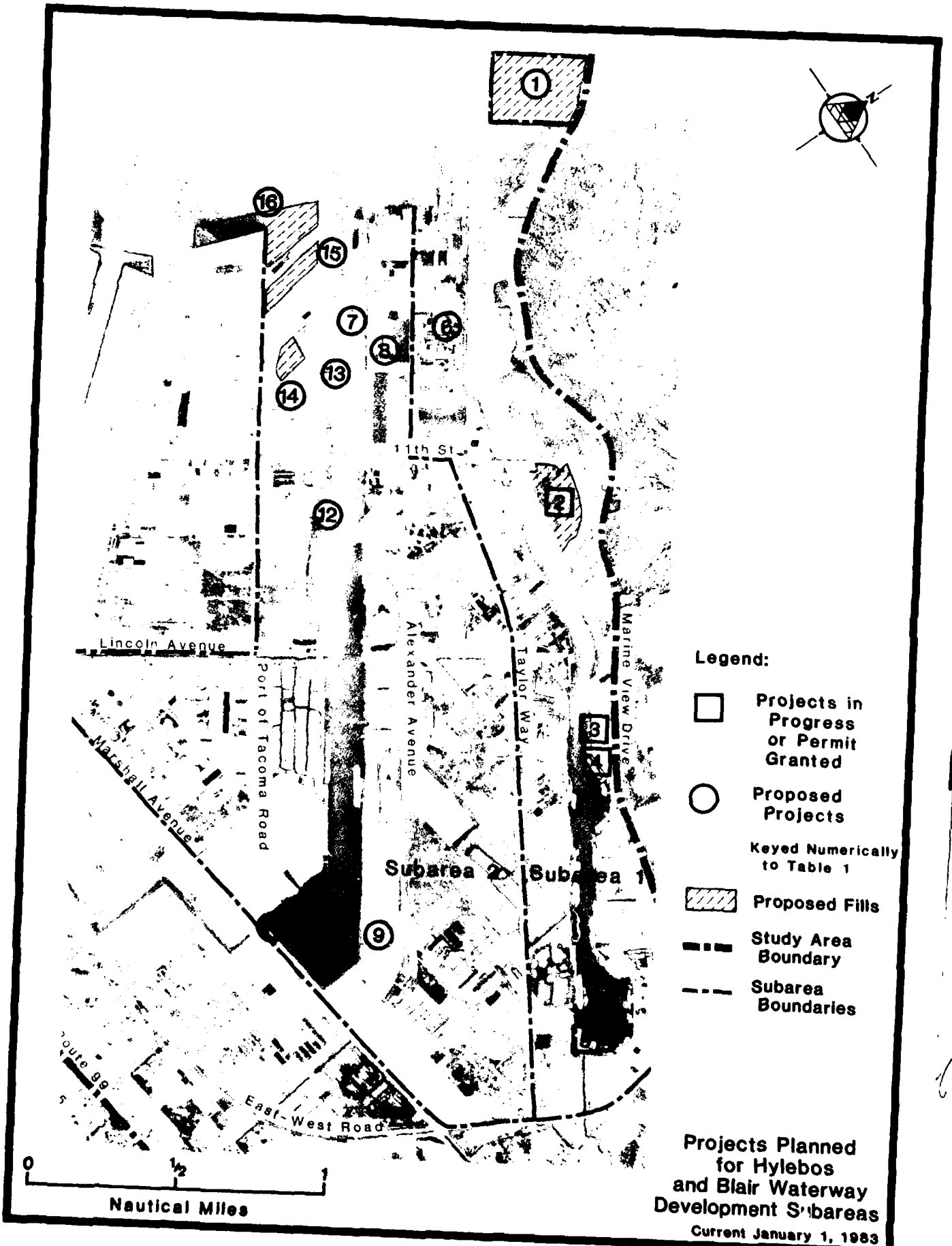

1
2
3
6
7
8
9
12
13
14
15
16
11th St
Lincoln Avenue
Port of Tacoma Road
Alexander Avenue
Taylor Way
Marine View Drive
Marshall Avenue
Subarea 2
Subarea 1
East-West Road
0
1/2
1
Nautical Miles
Legend:
Projects in Progress or Permit Granted
Proposed Projects
Keyed Numerically to Table 1
Proposed Fills
Study Area Boundary
Subarea Boundaries
Projects Planned for Hylebos and Blair Waterway Development Subareas
Current January 1, 1983

Figure 4

expansion of the existing Sound Refining Company facility on the northeast shore of the waterway (see Project Nos. 1 and 2 on Figure 4). Due to the intensive development already present in Hylebos Waterway, relatively little additional large-scale development is anticipated for this subarea through the year 2000. Vacant lands available for such development include the old City of Tacoma power plant site (located on the southwest shore of the waterway just south of the E. 11th Street Bridge), a large tidal flat on the waterway's northeast shore (just seaward of the E. 11th Street Bridge), and a smaller tidal flat on the waterway's northeast shore between the E. 11th Street Bridge and the Sound Refining facility. The developmental constraints associated with the two tidal flat sites (potential wetland characteristics and need for extensive fill) may preclude their ultimate development for industrial or commercial use.

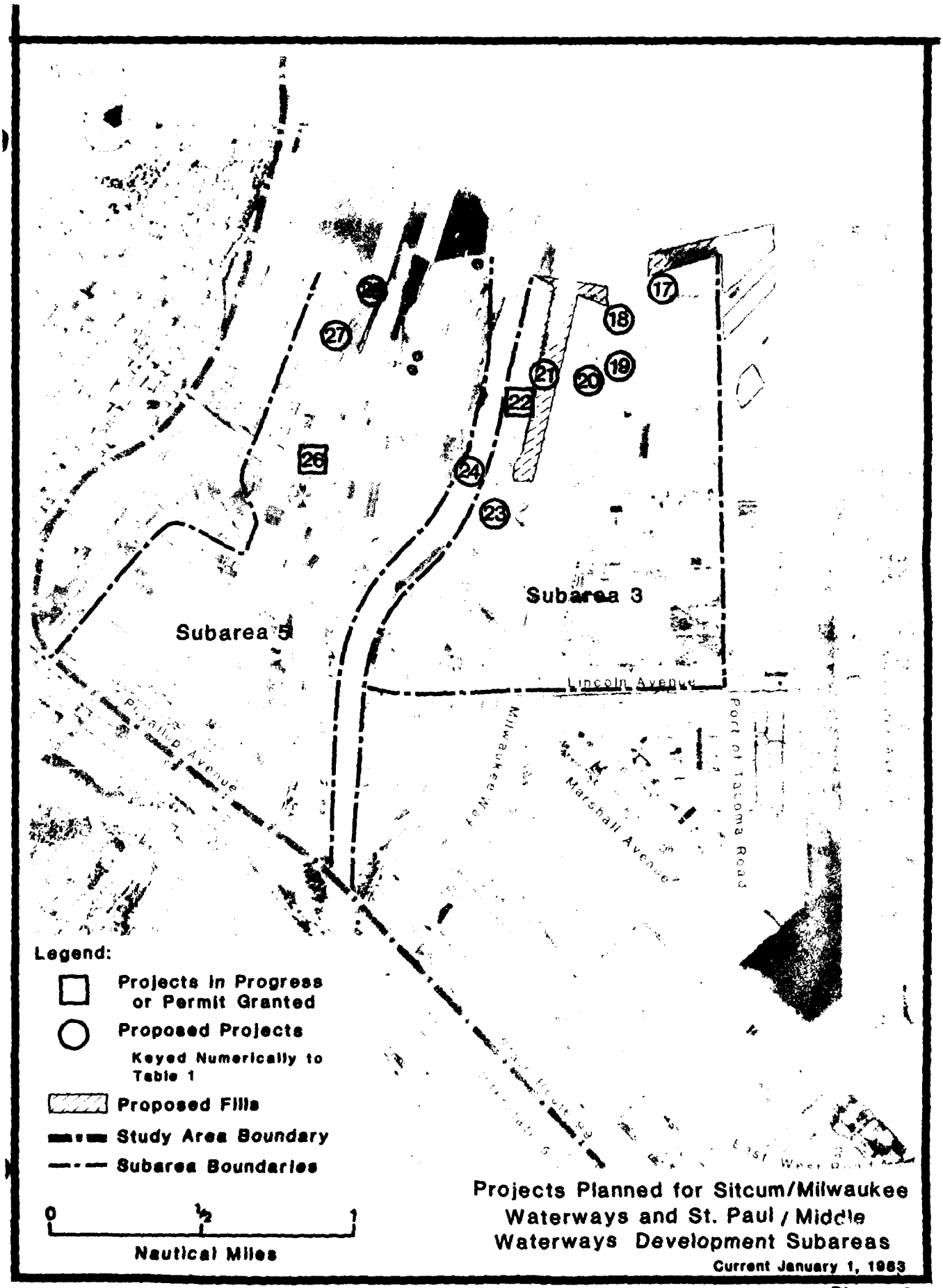
Major redevelopment may occur on sites currently occupied by other uses, particularly land-intensive uses such as the log storage and sort yards at the head of the waterway.

SUBAREA 2 - BLAIR WATERWAY

Projects planned for the Blair Waterway development subarea through the year 2000 are listed in Table 1 and depicted in Figure 4. Blair Waterway will be the site of much of the new large-scale industrial development planned or anticipated within the Port Industrial Area over the next two decades. Much of this development will represent terminal development and expansion of cargo handling facilities outlined in the Comprehensive Development Plan: Port of Tacoma (TAMS 1982). These projects will involve substantial dredging and filling operations and major construction of port facilities as described in Appendix A, Resource Information Synthesis, under the section entitled "Port of Tacoma." Major projects planned for Blair Waterway include dredging the waterway (some 2.5 million cubic yards) to restore channel depth. This will facilitate the development of the middle and inner sections of the waterway with water-dependent uses. Future industrial development on Blair Waterway is anticipated to generate substantial vessel traffic.

SUBAREA 3 - SITCUM/MILWAUKEE WATERWAYS

Projects planned for the Sitcum/Milwaukee waterways development subarea are listed in Table 1 and depicted in Figure 5. This subarea, like the Blair subarea, is the site of proposed large-scale port industrial development. Most of the major development proposed for this subarea through the year 2000 is related to the Port of Tacoma's plans to develop a containerized freight terminal in what is now Milwaukee Waterway. This project, proposed as part of the Comprehensive Development Plan: Port of Tacoma (TAMS 1982), will involve the filling of Milwaukee Waterway with either dredge materials from the Blair/Sitcum dredge project, clean upland fill, or a combination of both dredge materials and fill. This project is the subject of a federal Environmental Impact Statement currently being prepared by the Corps. Parcel 5, a tract of currently vacant land located across E. 11th Street from Milwaukee Waterway (Project No. 23 on Figure 5), also may be developed as a part of the Milwaukee Waterway containerized terminal.



Projects Planned for Sitcum/Milwaukee Waterways and St. Paul / Middle Waterways Development Subareas

Current January 1, 1983

Figure 5

Other projects designed to support this development will occur as well. Minor dredging of Sitcum Waterway will be conducted approximately every 10 years to remove shoal areas. In addition, the TOTE terminal (Totem Ocean Trailer Express, Inc.) on Sitcum will be relocated (probably in the Port Industrial Yard in Blair Waterway) to accommodate the new containerized cargo terminal to be developed in the Sitcum/Milwaukee subarea.

SUBAREA 4 - PORT INDUSTRIAL FLATS

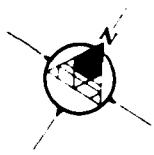
No specific projects have been identified for development within this subarea through the year 2000. However, future development is anticipated, based on the availability of large parcels of undeveloped land and good access to water and land transport routes. This subarea can be expected to support new medium- and large-scale industrial uses that are primarily dependent on land transportation systems (such as warehousing, storage, freight forwarding, and manufacturing uses).

SUBAREA 5 - ST. PAUL/MIDDLE WATERWAYS

Projects identified for development in this subarea are listed in Table 1 and are depicted in Figure 5. The general pattern of land uses in this subarea (primarily industrial) is anticipated to continue through the year 2000 (Tacoma Community Development Department 1982).

SUBAREA 6 - CITY WATERWAY

Projects planned for the City Waterway subarea are listed in Table 1 and depicted in Figure 6. These projects are consistent with the City Waterway Policy Plan (Tacoma Planning Department 1974) which provides for development of public water-oriented uses (marinas, parks, wharves, public facilities and open space restaurants, specialty food markets, etc.) and on-land residential uses on the west shore of the waterway and the east shore south of E. 15th Street. The east shore (north of E. 15th Street) will continue to support industrial uses. Some modest expansion of existing uses can be anticipated; however, development of major new industrial uses is unlikely.



0 1/2
Nautical Miles

Legend:

- Projects in Progress or Permit Granted
- Proposed Projects Keyed Numerically to Table 1
- Study Area Boundary
- Subarea Boundaries

Projects Planned for City Waterway Development Subarea

Current January 1, 1983

Figure 6

5. GENERAL PROJECT TYPES AND ASSOCIATED IMPACTS, MITIGATION MEASURES, AND ALTERNATIVES

INTRODUCTION

Projects scheduled for development in the study area will impose a variety of impacts on the natural and human environments. The magnitude, extent, duration, and probability of impact will vary with project location, scale, design, and the level of applied mitigation. However, generic project activities (such as dredging, placement of fills and piles, development of certain types of shore treatments and overwater structures, and marina development) impose certain identifiable impacts on the natural environment. Similarly, general types of project activities (dredging, placement of fills, marina development, major cargo terminal development, development of small water-oriented uses, and development of human use facilities adjacent to marine waterways) impose identifiable impacts on elements of the human environment. This section will present brief overviews of the types of impacts associated with each of these activities. Mitigation and alternatives will also be addressed in general terms. Project-specific impacts, mitigation, and alternatives will be summarized in Chapter 6. However, generic discussions in this section that are applicable to specific activities associated with individual projects will not be repeated.

The development of project facilities in the study area has the potential to conflict with Washington Department of Ecology's (WDOE) efforts under Superfund* to investigate and apply remedial action to areas of ground water and sediment contamination. Similarly, excavation of sites could reveal additional areas of contamination that would warrant remedial action under Superfund. In such cases, project development would be delayed until appropriate investigations were conducted and effective remedial action was designed. This could include the identification of contaminated sediment disposal sites both in and outside the COBS study area.

THE NATURAL ENVIRONMENT

Dredging

General Impacts

There are two major types of dredges: mechanical ("bucket") and hydraulic (Darnell et al. 1976). Mechanical dredges, including drag, bucket, and ladder dredges, all use some sort of scooping mechanism to remove bottom material and discharge the dredged materials alongside the dredge or into a barge adjacent to the dredge. Hydraulic dredges, including plain suction, draghead, and cutterhead types, contain a centrifugal pump fed through a suction line. They differ in their method of picking up material. Excavated material is discharged into the dredge itself, into adjacent barges, or piped to a disposal site. Hydraulic dredges are generally more efficient than mechanical dredges.

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*Activity being conducted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 ("Superfund") in the nearshore/tideflats Commencement Bay site is described in detail in Appendix A.

The main impact of dredging, by any method, is sediment removal and resultant creation of holes or channels. If large enough, the excavated areas can alter local circulation patterns. Holes can accumulate fine particulates and become anoxic if circulation is poor. These impacts may be of particular importance in waterways with limited flushing and/or high contaminant levels. Conversely, dredging of channels and shoreline areas containing existing pollutants can be effective for removing these contaminated sediments exposing cleaner underlying materials.

Depending on sediment type (i.e., fine or coarse material and dredge mode) dredging can create large turbidity clouds of suspended material. Hydraulic system dredges in common use in the Pacific Northwest create less turbidity at the dredge site than at the disposal site. Suspended material may be in a chemically reduced state and thus, at least temporarily, lower dissolved oxygen levels. Nutrients and toxic compounds contained in the sediments are also resuspended and possibly available for biological uptake (Peddicord and McFarland 1978). However, most toxicants in harbor sediments are sorbed or bound to fine particles and thus tend to remain with the dredged material (Allen and Hardy 1980). Several studies indicate that there is little significant release of many potentially toxic compounds such as oils and greases, pesticides, PCBs, and heavy metals into the water column during dredging or spoils disposal (see review by Allen and Hardy 1980). However, ammonia, phosphorous, manganese, and iron are released along with any free sulfides or hydrogen sulfide present. The latter is of particular concern in Commencement Bay because of its toxicity and its prevalence in sediments containing a high wood fiber content (Allen and Hardy 1980). As suspended materials settle onto adjacent bottom areas, they may smother benthic, infaunal organisms. The extent of the area affected will depend upon flushing characteristics.

The surficial layers of the dredged material often contain a variety of benthic infaunal organisms, including clams, crustaceans, and worms. These organisms can be physically destroyed during removal or buried during sediment discharge. Survival rates of benthic organisms in spoils discharge vary according to their depth of burial in the soils and their ability to dig out (Maurer et al. 1978).

Immediately following dredging, benthic biomass will be low. A new benthic faunal assemblage will colonize the dredged bottom over time (from a few weeks to several years; Allen and Hardy 1980); however, the new community may not necessarily match the previous one in terms of parameters such as productivity, biomass, diversity, or dominant organisms. Numerous environmental characteristics, including source of recruitment, sediments, circulation, degree of variability, and disturbance will in part determine the success of recolonization. Communities that develop in periodically disturbed, shallow water environments, such as the industrialized waterways of Commencement Bay, are in general more resilient than faunal communities in less disturbed habitats (e.g., Oliver et al. 1977). Recolonization of dredged bottom by certain short-lived, opportunistic or pioneering species may thus proceed rapidly in Commencement Bay assuming that the newly exposed bottom sediments and the adjacent water column do not contain substances inhibitory to invertebrate establishment.

Analysis of impacts imposed on the natural environment by open water disposal of dredged materials is beyond the COBS Phase II scope of services, and therefore is not included herein. The establishment of specific criteria for open-water disposal of toxic materials (expressed in terms of concentration and volume) and assessments of acceptable disposal sites for contaminated sediments are also beyond the Phase II scope of services.

Mitigation

Measures available to mitigate dredging impacts are directed at the two major issues associated with dredging: water quality and habitat disturbance. Mitigation design, therefore, often must entail tradeoffs between dredging methods designed to reduce water quality impacts at the dredge site and disposal methods designed to reduce possible impacts at the disposal site. For example, mechanical dredging has the potential to degrade water quality at the dredge site while use of a hydraulic cutterhead will reduce the potential for water quality impacts at the dredge site; however, more contaminants will be retained in dredged materials, causing potential impacts at the disposal site. Existing conditions such as the nature or amount of toxic sediments at the dredge site and the availability or absence of disposal sites with low environmental sensitivity should be carefully analyzed to determine the best tradeoffs involving dredging and disposal methods.

Timing of dredging and disposal activities are also important considerations. These activities must be scheduled carefully to avoid sensitive periods for key species and for seasonal periods of low ambient water quality. For example, work in Commencement Bay during the period from August through February will reduce potential conflict with outmigrating juvenile salmonids.

Water Quality: Methods available to mitigate water quality impacts at the dredge site in addition to the selection of a dredging process include silt curtains or similar devices which control adjacent water turbidity and to some degree control the horizontal transport of larger sized sediments which may have associated toxic contaminants.

Both immediate and delayed water quality impacts at the disposal site can be mitigated by several methods. As dredging progresses, multiple cells with controlling weirs can be incorporated to retain effluents leaving the dredged materials after disposal. If necessary, materials can be added to these fluid components to facilitate faster settling. In more extreme cases, the disposal sites final effluent may require dilution (with less contaminated ambient water) before it is disposed or subjected to a diffuser process or injection into a fast-diluting environment (i.e., the edge of a moving river into an estuary).

To mitigate longer term leaching of contaminants to nearby surface or ground water bodies, disposal cells can be lined with various impermeable materials. The fill site also can be capped with an impermeable surface (asphalt) to eliminate vertical percolation through the fill from rain or other surface water sources.

Specific disposal sites and treatment for contaminated dredged materials designated by Washington State as "Dangerous Waste" will have to be identified as part of specific dredging mitigation plans.

Habitat Disturbance: Methods available to mitigate habitat disturbance due to dredging include enhancement of existing habitats of similar type and biological value and in-kind replacement of habitat at a site near the habitat disturbance.

A great deal of concern centers around the loss of shallow water habitat used by rearing juvenile salmonids. Replacement of such habitat is a new technique that is currently being attempted on a small scale in Commencement Bay. Federal and state resource agencies have adopted policies directed at scaling mitigation to the value of the resource(s) to be potentially affected by the project development. For example, the U.S. Fish & Wildlife Service has classified habitat in Commencement Bay as having high value for evaluation species (salmonids and waterfowl) and thus has a goal of no net loss of in-kind habitat value (Stout 1983). Therefore, the in-kind replacement of habitat lost through development constitutes an acceptable mitigation within the Commencement Bay study area.

Measures currently being implemented in, or conceived for, the COBS study area include in-kind replacement (preferably on site) of valuable and limited, intertidal and shallow subtidal lands lost to any proposed dredge/fill actions, or altered by other project actions.

The Port of Tacoma is currently reviewing several mitigation possibilities for nearshore marine lands lost in proposed dredge/fill actions. This review includes a feasibility study of a stage-developed wetland area on the Puyallup River to replace wetlands lost in the proposed Parcel 5 fill (Project No. 23). One concept being considered includes the creation of substantially more wetland area than will be lost at the Parcel 5 site, resulting in "banking" (that is, the creation of additional habitat to compensate for future nearshore/wetland losses). As part of the NEPA/SEPA EIS evaluations of the proposed Milwaukee Waterway fill (Project No. 21), the port is also assessing the value of filling deeper nearshore areas (such as at the mouth of Milwaukee Waterway) to shallower depths to create replacement juvenile salmonid habitat for that lost by filling Milwaukee Waterway. The port is both studying eelgrass transplantation as possible mitigation for losses of similar habitats, and investigating salmonid use of environments involving piles, overwater structures, and other man-made structures.

Paxport Mills is working with the resource agencies to create enhanced salmonid rearing habitat in Middle Waterway to replace habitat lost in facility expansion and associated waterway filling (see discussion of mitigation for Project No. 25).

Alternatives

Alternatives are limited to various methods of dredging and disposal (considered under mitigation) and altering the proposed use of an area to lessen or obviate the need for dredging at the location in question.

Placement of Fills

General Impacts

The primary direct impact of fill placement is loss of the existing biological community through smothering of the habitat. The degree of impact will vary according to characteristics of the habitat to be filled. Filling of nearshore intertidal and subtidal areas can eliminate important habitat for various species at different trophic levels. Prediction of resulting impacts is tenuous at best; however, reduced biological productivity is usually the ultimate outcome. On the other hand, in some locales, dredged material can be used beneficially to increase or create more productive habitats.

Historical loss of nearshore habitat in Commencement Bay through filling and other activities has eliminated over 95 percent of the original wetlands (U.S. Fish and Wildlife Service 1979). Continued fill of remaining areas must be viewed not only in terms of the quantity of habitat lost from an individual project but also in terms of the action's cumulative impact. Remaining wetland habitats in Commencement Bay (about 124 acres, intertidal and freshwater) have been identified by Boule and Dybdahl (1981). Fill projects proposed in these areas will have greater impact through habitat loss than fill proposed for non-wetland areas that have been previously modified. Intertidal soft bottom habitats are likewise limited in extent along the shoreline of the study area. These habitats are important to juvenile salmonids during their early estuarine residency for feeding and refuge from deeper water predators. Progressive elimination of these remaining habitats (without creation of new equivalent habitat) will be deleterious to salmonid use of the bay.

The composition of fill material is a factor in determining the impact of a fill project. Clean upland or dredged material may have little impact besides covering and smothering the existing substrate and biota. Excessive amounts of fine materials (i.e., mud, silt) may cause short-term water quality problems from turbidity and sedimentation. As described in the "Dredging" section, most potential toxicants in the dredged material remain with the sediments and are redeposited in the disposal area. Nonetheless, water runoff from the disposal area may contain elevated concentrations of bio-stimulatory nutrients and trace elements (phosphorous, nitrogen, manganese, iron) as well as bio-inhibitory or toxic materials (sulfides, ammonia, and, in lesser amounts, heavy metals, hydrocarbons). Various means of containment and treatment may be applied to this effluent to reduce impacts in the environment. Removal of contaminated sediments from a waterway bottom and placement as fill may lead to long-term leaching of incorporated toxicants as surface and ground water move over and through the fill material. A variety of recent bioassay investigations (Swartz et al. 1982; Ott et al. 1982; Chapman et al. 1982; Pierson et al. 1983) have suggested both toxic and nontoxic effects on test organisms from exposure to Commencement Bay sediments. These studies suggest a high degree of "patchiness" in sediment toxicity (i.e., an area of highly toxic sediments may lie very close to areas of nontoxic sediment within the same waterway). Thus, a fill using materials from adjacent marine areas within the bay may contain sediments of sharply varied chemical (and physical) natures. It is possible that some sediments may contain sufficiently high concentrations of contaminant(s) to require special disposal methods and perhaps disposal outside Pierce County at an approved hazardous waste disposal site.

Mitigation

Onsite mitigation of the effects of filling in marine environments can be achieved through:

- Control of disposal practices for placement of dredged materials, including careful site selection and detailed disposal plans.
- Careful selection of the fill material;
- Control of the method of placement (e.g., behind a berm or bulkhead);
- Control and monitoring of runoff of water from the fill material, especially if suspected of containing or known to contain toxicants; and by
- Timing of activities that may affect sensitive life stages of key species.

Selection of the nature and configuration of the face of the fill to maximize utility to important biota can also lessen impacts. A maximum slope of 1.5 to 1.0 (horizontal to vertical) is favored by the Washington State Department of Fisheries to avoid delay of migrating juvenile salmonids (e.g., U.S. Army Corps of Engineers, Seattle District 1983). Even shallower slopes are preferable and may support a finer substrate (gravel/sand) that will maximize production of epibenthic crustaceans favored as food by many juvenile salmonids.

In-kind replacement of habitat is considered by resource agencies to be acceptable and effective mitigation of habitat that is lost or degraded due to placement of dredged or fill materials (see discussion of dredging mitigation above). Replacement of valuable habitat or habitat that may have characteristics of particular value to sensitive species will normally be evaluated on a case-by-case basis. Further study may be necessary to assess the benefits associated with replacement of habitat of questionable value (e.g., shaded habitat for juvenile salmonids).

Alternatives

Alternative materials, methods, and designs of fill are considered above under mitigation. Alternative approaches to achieve the desired near-water work area might include construction of a full or partial pile-supported wharf in place of all or part of the planned fill. A solid planked or concrete surfaced wharf may not be appreciably less harmful than a fill but a detached wharf connected to shore by a relatively narrow (less than 40 feet) apron or ramp has several advantages:

- No alteration of existing shorelines would occur.
- Shallow shoreline areas where benthic production important to juvenile salmonids occurs would be subjected to minimum shading.
- Longshore movements of fish, especially juvenile salmonids, would not be unduly restricted; however, an open steel grating may be needed on the ramp.

- Piles would support flora and fauna to enhance overall area productivity.

It should be noted that a wharf configuration incorporating a ramp or apron would have the potential for reducing the operational efficiency of the facility.

Placement of Piles

General Impacts

Impacts associated with piledriving in aquatic environments generally include those associated with direct bottom disturbance, waterborne noise and vibration, minor habitat loss, current or circulation changes, and changes of the resident biotic community.

Individual placement of piles removes a relatively small amount of benthic habitat; however, large numbers of piles in a small area, such as for dolphins or mooring buoys, remove a proportionately greater amount. Short-term increases in turbidity can accompany construction involving the placement of piles. Piledriving also can cause minor redistribution of sediment-bound toxicants through resuspension in the water column and subsequent transport.

Large numbers of piles can alter the natural circulation and mixing patterns by breaking up the flow of water through an area and creating eddies. Such concentrations of piles generally decrease water movement through an area, thereby limiting tidal flushing and increasing residence time of waterborne materials.

The introduction of piles changes a former open-water (nearshore or offshore) habitat to one containing intertidal substrate for both attached algae and invertebrates, and pile-associated invertebrates and fish. A large number of invertebrate species and algae commonly colonize pilings and attract species (e.g., pile perch, dock shrimp) that prey on them. Birds will be attracted to these structures as resting or perching areas. Portions of the fouling community sloughed from the piles by vessels, wave action, or waterborne debris provide a food resource for benthic scavengers such as crabs and shrimp and may significantly alter the physical characteristics of the bottom (e.g., long-term buildup of mussel and barnacle shell material in a fine sediment matrix).

Construction and operation impacts of pile-supported structures can include discharges of toxicants or petroleum products into adjacent waters by vessels used in construction or berthed at the structures. Transfer spills (spillage of materials during on- and offloading operations) can also occur.

Mitigation

Timing of pile installation to reduce interference with sensitive life stages of key species is perhaps the best mitigation of impacts of pile installation. Some alteration of the pattern and numbers of piles required may be feasible to minimize effects on circulation but the configuration will be largely dictated by structural requirements.

In areas of restricted circulation, a requirement for a minimum drying period for piles following pressure creosoting or other chemical treatment may reduce the release of soluble organic compounds to the water column.

Alternatives

Alternative piling materials (concrete, steel, wood) do not have greatly different environmental impacts but selection between them may be used to minimize maintenance cycles, number of piles required, etc.

Shore Treatments

General Impacts

Placement of near-vertical solid bulkheads where a sloped shoreline previously existed reduces food availability through benthic habitat loss for small fish including outmigrating juvenile salmonids. Heiser and Finn (1970) showed that pink and chum salmon fry migrating along shorelines in Puget Sound tended to school at the edge of vertical or near-vertical bulkheads, increasing their vulnerability to predators.

Shore treatments, to serve their intended function, are typically hard and relatively fixed in place; they therefore provide a hard substrate for colonization by a fairly diverse flora and fauna.

Solid Bulkheads: Construction of solid bulkheads eliminates intertidal and shallow subtidal nearshore habitat. Faunal communities colonizing the new structure are almost always less diverse than was the natural community. Bulkhead construction in exposed areas can cause reflection of waves, resulting in disturbance of adjacent sediment and possible erosion or bottom scouring. Groups of bulkheads can create channels or pockets where water circulation is generally poor.

Riprap (including slag): Shore protection construction using riprap results in habitat modification and associated impacts on biota. Riprapping buries the existing benthic community and provides for the eventual establishment of a new biota adapted for attachment to hard surfaces. Loss of nursery or feeding areas for juvenile fish can result if a former soft or mixed bottom habitat is replaced by riprap. Steep riprap with a smooth surface can result in the same interdiction of movement by small salmon noted for a vertical bulkhead (Heiser and Finn 1970). However, a coarse riprap material placed at a low angle of repose (less than 45 degrees) more closely simulates a natural shoreline, and permits near normal movement of these fish.

Certain substances historically used as riprap in the study area, such as smelter slag, may leach toxicants such as arsenic and other heavy metals under certain conditions, thereby adversely affecting water quality (Washington (State), Department of Ecology 1982). Degraded water quality can have serious impacts on biota both in the water column and sediments. No leachate impact is normally associated with riprap material consisting of rock, concrete, steel, or other inert substances.

Ramps: Impacts resulting from construction of ramps include loss of natural shallow water benthic habitat and modification of existing current patterns (if the ramp is large and exists as a solid structure). Operation frequently results in accidental spillage of fuel oils and other pollutants that degrade local water quality.

Mitigation

Sufficient data exist to permit necessary shore treatments with minimal environmental impact in most cases. Generally, such treatments should have slopes of less than 100 percent (1 to 1, horizontal to vertical) and should avoid presence of sharp concavities or cul-de-sacs. Material should be nontoxic. Individual particles should be large enough to be stable and hard enough to withstand weathering forces. This will minimize the need for maintenance and will maximize the long-term habitat value of the treatment.

The same timing considerations discussed previously apply equally to in-water work, although in many cases it may be desirable to accomplish major construction activities during low tide ("in the dry"), in which case timing restrictions may not apply.

Shore treatments in themselves or in addition to other projects could become mitigation. While yet in only the discussion stage, shallow subtidal sills (sheet pile or other structures) could be placed off steeper sloped shorelines. The area between shore and the sill could then be filled to recontour the shore with less slope and with a cleaner and more appropriate grain sized surface. Such actions could be undertaken in open areas as well as under existing overwater structures.

Alternatives

Alternative materials that may be applied as shore treatment are discussed above. An alternative to stabilizing or vertically bulkheading a given shoreline in some cases might be provided by construction of a pile-supported wharf with a ramp or apron to stable higher ground.

Marinas

General Impacts

All wet marinas, by definition, create low-energy embayments that are centers of increased human, automobile, and boat activity, as well as moorage, fueling, and overwater structures which have an associated set of "generic" impacts. These may include:

- Alteration of local water circulation patterns
- Alteration of existing habitat conditions
- Increased disturbance of sensitive biota
- Increased sources of fuels, sewage, and garbage

In addition, each of the several types of marinas that have been constructed in Puget Sound has a somewhat characteristic set of associated direct and indirect impacts on the environment. The following types are considered:

- Those delineated by a solid fill breakwater
- Those delineated by a floating breakwater
- Those dredged into lands above the normal high water line

Solid fill breakwater construction would have the obvious effect of burying some amount of existing benthic habitat. Marinas excavated into upland areas actually increase the availability of nearshore marine habitat while those constructed with floating breakwaters provide increased hard substrates in the form of floats and pilings (e.g., Kozloff 1973). Marinas delineated by a solid fill breakwater or excavated into uplands can have a severely or partially restricted circulation pattern (e.g., Cultus Bay Marina, Heiser and Finn 1970; Birch Bay Marina, Cardwell et al. 1978). Under such circumstances reduced water quality (low dissolved oxygen, high temperature and turbidity, possible buildup of spilled fuels, increased coliform bacteria levels) can result with attendant reductions in the quality of the biological environment within the marina. Bottom conditions may become stagnant (especially if a sill is present at the entrance) with an alteration of benthic species types toward those tolerant of very fine sediments and low oxygen levels. Increased sewage inputs can cause increases in fecal coliform levels within marinas (Cardwell et al. 1978) and conceivably could affect shellfish harvested nearby but outside the facility.

Most marinas in Puget Sound apparently have adequate circulation to maintain acceptable water quality conditions because their design includes multiple entrances (e.g., Shilshole Bay) or large openings oriented to enhance circulation (e.g., Kingston [Cardwell et al. 1978]) or otherwise provide adequate flushing (e.g., Squalicum, Skyline [Cardwell et al. 1980a,b]).

Fish use of marinas will be restricted to those tolerant of existing water quality conditions and those that can accommodate the available physical habitat types. In fact, the protected environment of marinas often leads to greater numbers of fish within than without the facility because juveniles of many species (e.g., clupeids and salmonids) favor such conditions (Cardwell et al. 1980a). Kills of more sensitive species that enter the marina may occur during intermittent periods of adverse conditions; e.g., extended hot weather periods. However, such kills have seldom been reported in Washington marinas. Observations by the Department of Fisheries (Heiser and Finn 1970; Cardwell et al. 1978, 1980a) have largely dispelled the often expressed fear that observed concentrations of juvenile salmonids entering an enclosed marina would suffer heavy predation losses. Apparently, the nature of the marina and associated activities may reduce the numbers of large predators present and enhance survival (Heiser and Finn 1970; Cardwell et al. 1980a). Overall diversity and standing crop of fish in the Birch Bay Marina was somewhat lower than that in surrounding natural waters (Cardwell et al. 1978) apparently due to absence of certain habitat types. Nonetheless, these workers found no evidence of any particular hazard to fish and felt that several pelagic forage species may have been rearing in the marina.

Marinas constructed using floating breakwaters will have a substantially lower impact on water circulation, water quality, and biota than solid breakwater-enclosed types. In some locations, floating breakwaters may

significantly restrict surface circulation but unrestricted circulation at depth should prevent water quality degradation (below ambient conditions) unless traps or sinks are created by dredging.

Fuel spills at marinas may result in the buildup of aromatic and polynuclear aromatic hydrocarbons in the sediments. If dredging is required to maintain marina basin depths, disposal of dredged material in fill sites could contaminate such sites with these hydrocarbons.

Primary impacts will be associated with occupation of previous open water areas by floats, boats, docks, maintenance facilities, and parking lots. Pelagic forage fish and juvenile salmonids might tend to concentrate within the marina in a manner similar to that observed in more enclosed marinas (with associated solid fill breakwaters). However, significant reductions in health or survival of these species are not likely under most circumstances.

Mitigation

Marinas typically entail a combination of bottom and shoreline modifications and structures, many of which are discussed along with associated potential mitigative measures elsewhere in this section. Additional mitigative measures specific to marina considerations include aspects of the overall design and operation of the facility.

Once a site and structural type of marina has been established, the major design consideration through which effects can be mitigated is the determination of the flushing characteristics of the structure (not a major factor with a floating breakwater design). Ambient tidal range, size and shape of the enclosure, its bathymetry, and its orientation to winds and currents are key factors in determining tidal flushing. Cardwell et al. (1980b) suggest a minimum 30 percent exchange as desirable to prevent nighttime dissolved oxygen depression from daytime plankton blooms. Physical modeling (e.g., Nece et al. 1980) is generally accepted as an adequate prediction of the flushing characteristics of planned marinas (e.g., U.S. Army Corps of Engineers, Seattle District 1983).

Other design measures that may be applied include elimination of vertical bulkheads, sills, isolated deepwater pockets, and sharp angles in the breakwater; minimizing inflow of possibly polluted surface water; provision of an isolated fueling basin; and requirement of automatic shutoff valves on fuel systems.

Marina pump-out facilities and spill prevention and control plans should be prepared as part of marina development and restrictions in the plans concerning dumping of sewage, solvents, fuels, paints, etc. should be strictly followed to reduce the risk of water quality degradation in the marina. In addition, provision of multiple disposal sites for these materials, a program to educate users, and an operating enforcement program will aid in this effort.

In-kind mitigation for specific lost resources (e.g., clam or eelgrass beds, littoral habitat) may be required in the general area of the

facility but opportunities for such actions are often limited. Contribution toward offsite enhancement activities is often considered as mitigation for lost rearing opportunities for juvenile salmonids.

Alternatives

Alternatives to wet marinas at a given site include dry storage in the same area, new wet storage at another sit or expansion of an existing facility in the area. In selecting a site for a marina, avoidance of especially productive or sensitive habitats (salt marshes, eelgrass beds, breeding areas) is obviously important.

Overwater Structures

General Impacts

A reluctance by juvenile anadromous salmonids to enter shoreline areas where the water is artificially darkened by man-made structures has been noted on several occasions (e.g., Heiser and Finn 1970; Weitkamp 1982). Even when pursued by a boat, schools of chum and chinook would not go under decked-over portions of a pile-supported pier apron in Elliott Bay (Weitkamp 1982). Similarly, Heiser and Finn (1970) were unable to chase schools of pink and chum fry into a culvert. Fish observed by Weitkamp (1982) appeared to be actively feeding on a narrow band within a few (2 to 4) meters of the outermost line of pilings and within the top 1 to 2 meters of the water column (some 10 m deep). No salmon fry were seen more than about a meter or so under the apron or along the riprapped bank where the apron joined the filled portion of the pier. Purse seining during the COBS I study indicated a considerable presence of juvenile salmon along pier fronts in Commencement Bay (Weitkamp and Schadt 1981) but no under-pier observations were made.

Based on these observations, salmon fry moving out through Commencement Bay in daylight periods and encountering an overwater structure (pile-supported pier, floating apron, covered wet moorage) might be expected to hesitate for a short time and then to skirt leisurely around the structure, pausing to feed on pelagic copepods and other small food organisms in the water column. The tendency to delay movements may be heightened if the overwater structure is attached to the shoreline such that shaded water is continuous from the shoreline to deep water.

Another impact of overwater structures is in shading of the water column and shallow benthic habitats, thereby reducing photosynthetic activity (primary productivity). Reductions in benthic algal growth can reduce the food base for many epibenthic crustaceans, in turn reducing the food base for many fish including juvenile salmonids. On the other hand, structures (piles, anchors, etc.) supporting overwater structures provide a hard substrate for colonization by a variety of plants and animals including several with food value (mussels, dock shrimp). Material sloughed from pilings may support benthic detritivores (e.g., Dungeness crab). Pilings and the overwater structure itself will encourage use by species (e.g., pile perch) favoring such habitats (the reef effect).

Potential predators were not observed to be a problem under the apron in the Elliott Bay studies (Weitkamp 1982) and few likely predators were taken near piers in the COBS work.

Mitigation

Several mitigative approaches can be taken to reduce the degree of shading of important shoreline (littoral) areas. These include:

- Minimizing the size of overwater structures;
- Minimizing intertidal and shallow subtidal area shading by placing the desired work area over deeper water with a narrow ramp connecting to the shore;
- Using open steel grating on portions of the structure, especially portions connecting to shore; this allows light penetration encouraging free passage of fish and benthic primary production; and
- Providing artificial lighting under the structure (not yet proven to be practical or justifiable).

Alternatives

Alternatives to overwater structures would often involve less desirable fill and/or dredging and bulkheading to accomplish the same purpose. In the case of marinas, dry storage removes much of the overwater coverage associated with floats. Uncovered wet moorage is probably less harmful to benthos and fish than covered moorage.

THE HUMAN ENVIRONMENT

Dredging

General Impacts

Dredging equipment, whether mechanical or hydraulic, is usually manned on a mobile floating barge, vessel, or other platform. The platform is either towed or self-propelled onto the dredge site, where it remains until dredging activities are terminated or until repositioning is required. If dredging occurs within vessel use areas (navigational channels, berths, entrances and exits to marina facilities), potential conflicts between dredge platforms and other vessels may occur. Since dredge platforms are stationary, other vessels are forced to stand clear, effectively reducing navigational options and increasing the potential for accident.

Dredging activities require a relatively small work force and, therefore, result in relatively few daily vehicle trips generated by worker vehicles along arterials serving the project area.

The method selected for disposal of dredged materials can also affect both land and water use. Methods of transport to upland disposal areas include truck, rail, and pipeline. Dredged materials in the study area

will likely be transported by either truck or pipeline, due to the general availability of potential disposal sites in the port industrial area. Rail transport of dredged materials may become a realistic option if a large volume of contaminated materials must be transported to a designated hazardous waste disposal site located at a substantial distance from the port industrial area.

Truck transport of a relatively large volume of dredged materials to an upland disposal site will generate a substantial increase in truck traffic along connecting arterials increasing the potential for traffic conflicts. The severity of this impact will increase proportionally with the volume of dredged materials. Use of a temporary pipeline to transport slurried dredge material to a nearby fill or disposal site will require development of a separate pipeline corridor or integration of the pipeline with existing transportation or utility corridors. Development of a separate pipeline corridor has the potential to conflict with existing land uses; integration with existing corridors reduces this potential interference, but increases the potential for interference with the operation and maintenance of transportation and utility systems.

Upland disposal of dredged materials has the potential for imposing additional land and water use impacts. Disposal of the materials can either enhance or detract from the development potential of a parcel of land, depending on the characteristics of the materials. If the dredged materials are relatively clean (i.e., contain no hazardous materials), use of the materials to fill low-lying lands can reduce flooding potential, enhance foundation and stability properties, and generally prepare the parcel for development. On the other hand, disposal of hazardous materials on a parcel has the potential to eliminate the development potential of the parcel over the long term. Such hazardous materials, therefore, are disposed in designated and licensed dump sites outside of the study area. For the purposes of this analysis and analysis of the individual projects below, it is assumed that none of the materials dredged from the waterways of the study area will contain hazardous constituents requiring such disposal.

Open water disposal of dredged materials will result in an increase in vessel traffic between the dredge and disposal sites. As the relatively unmaneuverable barges laden with dredge materials are towed to the open water disposal site, the potential for conflicts with other commercial and recreational vessels will occur. The number of vessel trips, and therefore the severity of navigational impact, will increase proportionally with the volume of dredged materials to be disposed. Once channels are dredged to design depths, vessel movement will be facilitated and potential for navigational hazard will be reduced.

Dredging activities have the potential of imposing substantial noise impacts on nearby sensitive receptors. Such activities (dredging and transport of dredged materials) produce an Equivalent Sound Level of between 86 and 92 decibels (dB) at distances between 450 and 1,000 feet. Actual generated sound levels will depend on the method of transport (truck or barge) employed.

Dredging activities in heavily developed or industrialized areas will have little or no impact on aesthetics, since such activities are generally consistent with view expectation. When dredging occurs in proximity to natural shorelines, some reduction in the aesthetic properties of the adjacent shoreline may be perceived by viewers. Dredge equipment may conflict visually with the form, line, color, and texture of the visual background; however, such impacts will be temporary, due to the relatively short-term nature of dredging operations at one location.

Recreational resources may be degraded if dredging is performed in waters used for recreational boating or sportsfishing. Operations of dredge platforms and dredge support vessels in navigation channels may create a potential navigational hazard for recreational vessels. Dredging will also temporarily degrade biological habitat (see discussion of dredging impacts on the natural environment), resulting in a temporary reduction in sportsfishing opportunities.

Maintenance dredging in navigational channels normally has little or no impact on cultural, historical, or archaeological resources. Upland disposal of dredged materials has the potential to disturb or destroy cultural resources if disposal sites are relatively unaltered by previous development.

Mitigation

Impacts of dredging on local arterials can be mitigated by scheduling truck transport of dredged materials so that it does not coincide with local traffic hours, thereby reducing the potential for interference with other traffic. If possible, a transport route should be selected to minimize truck time on heavily traveled arterials or routes located near noise-sensitive receptors such as residences, hospitals, schools, and other institutional uses. If pipeline transport is to be used, a corridor route should be selected that minimizes interference with other land uses, traffic circulation patterns, and existing utilities.

Adherence to Washington State noise regulations contained in the Washington Administrative Code (WAC) Chapter 173-60 (1980) will partially mitigate the noise impacts associated with dredging operations. These regulations require that such activities between the hours of 10:00 p.m. and 7:00 a.m. impose no more than 60 dB on nearby sensitive noise receptors (see Methodology--Noise in Appendix C). Construction noise levels are exempt from WAC regulation between 7:00 a.m. and 10:00 p.m., however. Although dredging activities will not violate the code there will be no mitigation of real noise impacts during these hours.

Measures for reducing the effects of dredging on the natural environment outlined in the preceding section (mode, timing, location and mode of disposal, etc.) will effectively reduce impacts on sportsfishing resources. Minimization of time-in-channel by dredging platforms and associated vessels will also reduce the potential for vessel conflicts and navigation hazards.

Impacts on cultural, historical, and archaeological resources can be mitigated through responsible site selection, verifying the potential for

existence of such resources onsite from available data sources (including local and state historical preservation societies and other cognizant agencies), and site reconnaissance prior to modification.

Alternatives

Please see discussion of alternatives to dredging presented in the preceding section (Natural Environment).

Placement of Fills

Filling activities impose essentially the same impacts on the human environment as upland disposal of dredged materials. Filling requires a construction work force to place, compact, and grade the fill and the movement of fill from its source to the fill site. These activities will result in increases in the use of transportation facilities that are directly proportional to the size of the construction work force and the volume of the fill to be placed.

Fill from upland sources may be transported by truck, barge, or rail* depending upon the distance of the fill source from the site to be filled and the volume of fill required. For the purposes of this analysis, truck or barge transport of upland fill to the fill site will be assumed for all projects in the study area due to the availability of local fill sources. Impacts associated with transport of fill material are identical to those associated with truck and barge transport of dredged materials discussed above. Generally, the use of any existing transportation system to move fill materials will reduce the existing surplus capacity of the system (thereby reducing the system's level of service) and increase the potential for vehicular or vessel conflicts.

Several projects proposed in the port industrial area involve the complete filling of old berths (and in one case, an entire waterway) and major extensions of existing peninsulas between waterways to create large-scale land areas for future redevelopment as marine terminals. While these fills will eliminate existing water areas either currently used or suitable for vessel transport, existing and future vessel use will be redistributed to other (and in most cases, adjacent) water areas serving the new marine terminal facilities. Therefore, water use will be altered, rather than truly eliminated, by major fills proposed for the study area.

Filling (whether by placement of fill in water or in upland disposal sites) is usually performed to prepare a site for future development. While the fully developed site will generate additional impacts on land and water transportation facilities, these impacts are dependent upon the nature of development, and are not a direct impact of filling.

Filling will generate noise of a similar magnitude of that created by dredging and associated transport activities. Again, noise levels will vary slightly with the type of transport selected. The severity of the

*As discussed above, dredged material for use as fill may be transported via pipeline.

noise impact will be dependent on the proximity of the fill site to sensitive noise receptors. While noise associated with fill activities are temporary, the duration of the impact is directly proportional to the size of the area being filled.

Fill activities, like dredge and disposal operations, will generate little or no aesthetic impact in highly modified or developed areas. However, filling activities may create aesthetic impacts perceived to be adverse to some viewers in areas where: (1) significant natural amenities are present, (2) development is relatively sparse, or (3) such activities generally are incongruous with nearby areas.

Filling activities will impose the same general impacts on recreational resources as described above for dredging and associated materials transport activities. The most substantial fill-related impacts are the destruction or severe alteration of natural habitat and water courses used by sportsfishermen, boaters, beachcombers, birdwatchers, and others engaged in recreational pursuits.

Fill-related impacts on historical, cultural, and archaeological resources are essentially the same as those described for dredging. The most severe impacts would be generated by destruction or severe modification of cultural resources due to the filling of previously undisturbed areas.

Mitigation

Impacts generated by fill activities on local arterials and access roads can be mitigated by scheduling transport activities for nonpeak traffic hours and routing truck traffic along roadways where traffic volumes are less. Where feasible, large volumes of fill (including both clean upland fill as well as dredged materials for placement as fill) should be transported by barge or rail to reduce the number of truck trips along local road systems. The source of dredged materials to be used as fill should be selected carefully to maximize land and water use. Where possible, relatively uncontaminated dredged materials and clean fill from dredging and site preparation activities within the port industrial area should be used for fill. Where placement of large volumes of clean upland fill is required, borrow sources near the port industrial area should be selected to localize impacts on transportation systems. Increased vehicular traffic generated by the relatively large work forces required for large-scale fill projects can be mitigated by adjusting construction shifts to commence and end during nonpeak traffic hours.

Measures available to reduce noise and cultural/historic/archaeological impacts associated with dredging and dredged material transport are equally applicable to fill projects.

Alternatives

Please see discussion of alternatives to filling discussed in the preceding Natural Environment section.

Marine Terminals

Development and operation of marine cargo terminals in a port industrial area such as the Port of Tacoma will result in substantial land and water use impacts. Construction impacts will be temporary, lasting from 6 months to 2 years or more. Operations impacts will occur for the life of the project (up to 50 years).

Construction Impacts

During construction, a relatively large work force may be employed onsite (depending on scale), resulting in substantial increases in traffic volumes along nearby road systems. Construction materials will be delivered via truck, barges and other types of vessels, and rail, reducing surplus carrying capacity of overland and water transportation systems. Site preparation may include dredging and/or filling with associated construction impacts as described in preceding sections. The magnitude and extent of impacts on existing transportation facilities will depend on the size of the marine terminal facility.

Construction of wharves and other facilities located on or immediately adjacent to the shoreline and shore treatments will generate substantial barge and construction vessel activity to support piledriving, dredging, and inspection activities. These activities may interfere with vessels using adjacent waters; the degree of interference will depend on the proximity of the project facilities to navigational channels and other water-oriented use.

Construction activities (such as piledriving, filling, grading, building and facilities construction) can impose substantial noise impacts on nearby sensitive receptors. Development of marine terminals in the port industrial area will generate temporary sound levels of 90 dBA and greater within 1,500 feet of the construction site. Temporary construction noise impacts are exempt from the state noise regulations (WAC 173-60 [1980]) between the hours of 7:00 a.m. and 10:00 p.m. Although exempt from the WAC regulations, real noise impacts will still occur during construction. While the noise regulations limit noise impacts on sensitive residential (Class A) noise receptors (see further discussion in Appendix C) between the hours of 10:00 p.m. and 7:00 a.m. to less than 60 dBA, marine terminal development in the port industrial area is not likely to occur within 2,000 to 2,500 feet of any sensitive residential or other uses, thereby reducing noise levels imposed on such uses to less than 60 dBA. Therefore, around-the-clock construction will be possible in most cases.

The aesthetic impact of marine terminal construction will depend upon visual contrasts in form, line, color, and texture with existing industrial and commercial activity. Construction equipment, barges, etc. will be similar in scale and shape to other industrial equipment and activities in the area, therefore visual contrasts will be small.

Dredging and filling activities associated with marine terminal development will generate impacts on recreational use as described under the appropriate sections below. Construction support vessels used

for piledriving, inspections, etc. will potentially interfere with recreational boating in the area of construction, although this impact is anticipated to be minor.

Impacts to historic, cultural, and archaeological resources may accrue due to dredging and filling activities, as well as site grading and preparation if marine terminal development occurs in relatively undisturbed areas. These areas are few; therefore, site preparation for marine terminal development in the port industrial area will generally impose minor or no impacts on historic/cultural/archaeological resources.

Operations Impacts

Marine terminal development may generate direct changes in land and water use through redevelopment of an existing use or development of vacant lands. The extent of this impact will depend on location, scale, and the character of land and water use near the terminal site.

Operation of marine terminal facilities will result in increases in truck and workers' automobile traffic along local road systems. Bulk cargo terminals will depend heavily on port and regional rail systems for transportation of grain, work products, and ores. Neo-bulk terminals will use rail systems as well as road systems to transport logs and imported light trucks and autos. Although local and regional vehicle and rail traffic will increase as a result of terminal operations, this impact will be inversely proportional with distance; that is, impacts on land transportation systems will decrease with distance from the terminal, as traffic becomes distributed within the regional network.

All marine terminals, by definition, will generate a substantial increase in commercial vessel traffic. The terminals will be served by large specialized cargo vessels making as many as 4 to 5 calls per week. While increase in vessel volumes will create the potential for vessel conflicts in the marine waterways of the study area, the net increase in total vessel traffic (less than one vessel per day per terminal) will not substantially reduce the surplus carrying capacity of the waterways. Like vehicular and rail traffic, vessel traffic generated by marine terminal development will add incrementally to regional vessel traffic; however, due to the distributive effect and the relatively small number of vessels generated, water use impacts will not be substa ial.

The terminal may also result in a change in vessel use characteri near the site, introducing large commercial vessels with accompanying tugs into previously unused areas or areas used primarily by smaller vessels. This change in vessel mix may not create a substantial decrease in navigational safety. However, if developed near a marina, the potential for conflicts with recreational boats could increase dramatically during cargo vessel approaches and departures.

Vessel activities associated with terminal operations may slightly degrade other recreational resources due to disturbances to fish and invertebrates in the vicinity of terminal berths. Fish migration may be adversely affected due to selection of shore treatments; however, new habitat may also be created by terminal development and operation

(see discussion of general project impacts on the Natural Environment above).

The aesthetic impact of marine terminal operation will depend upon visual contrasts in form, line, color, and texture with existing buildings and wharves. Given existing industrial development and similar marine terminals in the study area, projects that repeat existing contrasts will have little aesthetic impact.

Marine terminal operation in the port industrial area will have little impact on historic/cultural/archaeological resources in the study area.

Mitigation

Marine terminals should be developed only in areas planned for industrial development and where road and rail systems are generally sufficient to accommodate terminal development and operation.

Close-in traffic impacts can be mitigated by scheduling the beginning and end of construction shifts so as not to coincide with peak traffic hours. Operation traffic impacts can be mitigated by improvements to road systems accessing the terminal facilities, signalization, and onsite circulation patterns.

Where possible, terminals should not be developed adjacent or in close proximity to marinas to reduce the potential for vessel conflict. However, prudent seamanship remains the most effective mitigation for navigational hazard potential.

Alternatives

Alternatives associated with marine terminal development include the build/no action option, site options, scale and functional options, and selection of an alternate use for the site.

The decision to develop or not to develop a marine terminal is primarily driven by economic considerations. The natural and human impacts described above and in the Natural Environment section would not occur if the terminal is not developed. If developed, the impacts described above would occur at the site selected. Responsible site selection will mitigate many of the natural and human impacts. Location within a given waterway and interaction with surrounding uses should be considered; that is, site selection should be approached with an understanding of the synergistic effects of project-related impacts with impacts imposed by adjacent and nearby uses. The terminal's scale and function (type of cargo handled) will affect the level of project impact as these factors will dictate the intensity with which natural and human systems are used. The selection of an alternate use for the site will, like the build/no action option, be driven by economic considerations; however, site

selection for any alternative use will be directed by both economic and environmental considerations. The variables that influence decisions on site use are too numerous for discussion here; however, site options will be discussed generally on a site-by-site basis in Chapter 6.

Marinas

The major impact associated with marina development and operation is the generation of relatively large numbers of vehicle and vessel trips. This increased use of roads and waters in the vicinity of marina facilities has the potential to reduce or, in extreme cases, exceed the carrying capacity of roads and approach waterways.

Marina construction will generate additional vehicular and vessel traffic as a result of associated dredging, fill, piledriving, dock and breakwater placement, and onshore facilities construction. The magnitude and extent of construction impacts (as described in previous sections) are directly proportional to marina size.

Marina operation imposes the greatest potential impact on land and water transportation systems.* On a peak summer weekend day, large marinas will generate up to three vehicle trips and one vessel trip per moorage. In areas where weekend activity is intense, or where a number of marinas are located, the potential for high volumes of traffic, reduced levels of service, and increased vehicular and vessel conflicts will be created. Such impacts will be directly proportional to the size of the marinas.

Recreational vessel traffic generated by marinas, as mentioned above, has the potential to conflict with commercial vessel traffic. Since volumes of recreational vessel traffic disperses over distance, this impact would be most severe near the exits and entrances to the marina.

Conversion of land and water uses to marina-related uses will have the greatest potential impacts in areas where existing land and water use is not intensive, or where a substantial number of marinas already exist in proximity to water-oriented industrial uses.

Marina construction has the potential to impose relatively high sound levels on adjacent properties, due to site preparation, filling, dredging, and piledriving. Marinas planned for the study area will be developed either in City Waterway (adjacent to the Tacoma Central Business District) or along a relatively undeveloped shoreline north of Commencement Bay near residential uses below Marine View Drive.

While construction-related noise impacts are exempt from state noise ordinances from 7:00 a.m. to 10:00 p.m., these impacts may still increase noise levels substantially at nearby sensitive receptors. Noise impacts during operation will be less severe, with major marina-associated noise attributable to boat motors and traffic noise.

Aesthetic impacts associated with marina development will depend on visual contrasts of the facility with the surroundings and upon view expectation for the area. Development of a marina in a relatively undeveloped area with natural amenities may be perceived by some viewers as a human intrusion on the natural environment. Conversely, other viewers may perceive a marina as a visually compatible component of a

*Assumptions of vehicle and vessel generation used to determine the magnitude of marina impacts on such systems are described in detail in Appendix C, Methodology by Resource Area.

natural background. Marina development in a developed area will likely be regarded as less of an intrusion by virtually all viewers. In any case, the aesthetic impacts imposed by marina development is highly subjective and will vary in severity or benefit with the individual viewer.

Recreational impacts associated with marina development will generally be positive. Recreational opportunities may be temporarily lost as a result of marina construction activities such as piledriving and other construction-related vessel activities (fish disturbance, navigational hazard to recreational boaters). However, marina operations will generally enhance recreational opportunities in the study area. It should be noted that development of marinas in areas with natural amenities may degrade the use of the site and adjacent areas for other recreational pursuits such as birdwatching and fishing.

Dredging, filling, and site preparation in relatively undisturbed areas in support of marina development has the potential for destroying or degrading historic, cultural, and archaeological resources. Marina development in previously filled, dredged, or modified areas such as most lands in the port industrial area will impose only minor impacts, if any. Development of marinas in proximity to historic uses along City Waterway will result in increased public use of adjacent water areas.

Mitigation

Most major impacts associated with marina development can be mitigated by prudent site selection. Large marinas should be located in areas with good public access. Local road systems serving the marina site should either have or be expandable to have sufficient excess capacity to accommodate generated vehicular traffic volumes. Marinas should be developed and located so as to minimize the potential for conflicts between marina-generated vessel traffic and other vessel traffic using designated navigational channels in the area. Siting of marinas should consider the intensity of vessel use in the area (including recreational vessel trips generated by other nearby marinas). Mitigation of dredging and filling impacts identified above should be applied as appropriate.

Construction-related noise impacts from dredging, filling, and pile-driving will be partially mitigated through compliance with state regulations (WAC 173-60 [1980]). The regulations limit noise imacts on sensitive residential noise receptors to less than 60 dBA between 10:00 p.m. and 7:00 a.m.

Alternatives

Alternatives associated with marina development include: (1) the build/no action option, (2) alternative site options, (3) alternative use of sites suitable for marina development, and (4) site design and facility options. The discussion of alternatives to marine terminal development above is equally applicable to the first three marina alternatives. Site design and facility options include exclusive development (or various combinations) of wet or dry moorages; selection of the configuration of wet moorage facilities (and distance to which the facilities encroach into the adjacent waterway); internal traffic and vessel circulation

patterns; required improvements to road systems accessing the marina site (as appropriate to accommodate potentially large automobile volumes). Selection among design options must consider the intensity of surrounding land and water uses and specific options to minimize adverse impacts associated with the generation of substantial vehicle and vessel traffic along nearby roads and water use areas.

Small Water-Oriented Uses

Development and operation of small (nonmarina) commercial and industrial water-oriented uses will impose essentially the same types of impacts on the human environment as marine terminal development. The magnitude and extent will vary widely, primarily due to size and function.

For the most part, the small water-oriented uses most likely to develop in the study area will consist of relatively small-scale wharf and pier facilities or other overwater structures designed to support onshore commercial and industrial uses. Construction and operation of such facilities will likely not impose major impacts on land and water use if developed in areas dedicated principally to commercial or industrial uses. Due to their relative size, small water-oriented uses do not usually generate increases in vehicular or vessel volumes in the area. Construction and operation of such facilities in previously developed areas rarely impose major impacts on noise, aesthetic, recreational, or historic/cultural/archaeological resources. Development of small water-oriented facilities will impose more severe impacts in those areas where: (1) development is sparse, (2) natural amenities exist, or (3) sensitive receptors (residences, hospitals, public use areas) are nearby.

Nonmarina water-oriented public uses (such as parks, public fishing piers, pedestrian walkways, etc.) will generate automobile traffic along local roads and will result in increased human use of adjacent shorelines. These activities will contribute to ambient sound levels.

Mitigation

Measures available to mitigate land and water use impacts associated with small (nonmarina) water-oriented uses are essentially the same as those available for mitigation of land and water use impacts imposed by marine terminals and marinas. Such facilities should be located in areas where land and water transportation systems have sufficient surplus carrying capacity and where associated commercial and industrial activities are consistent and do not conflict with nearby uses. Adherence to noise regulations will mitigate nighttime construction impacts imposed by dredging, filling, and piledriving on nearby noise-sensitive uses.

Water-oriented public uses should be developed in areas with aesthetic or historic/cultural qualities. Such uses should have good public access facilities and should be compatible with adjacent uses.

Alternatives

Alternatives to development of a small (nonmarina) water-oriented commercial and industrial use are essentially the same as alternatives associated with marine terminal and marina development (see appropriate discussions above). However, development of wharf, pier, and berth facilities at an existing use imposes severe siting restrictions. Owners of uses requiring expanded facilities normally do not own and may not have access to other properties suitable for facilities development. Therefore, the development of such facilities at an existing use on an alternative site is not a realistic option. Alternatives in such cases are limited to the build/no action option, development of alternative uses for the site, and design alternatives within the site. Selection among these alternatives is, like other types of development, subject to economic and environmental considerations.

Nonwater-Oriented Uses

Nonwater-oriented uses, by definition, are not dependent on water transport of goods and products. Such uses may include warehouse and distribution centers, commercial service outlets, and other uses dependent primarily on road and rail systems. Development of these uses will have little direct impact on water transportation systems, but will generate additional truck, automobile, and possibly rail traffic along local and regional land transportation systems. The magnitude and extent of this impact will depend upon the scale and function of the use. During construction, use of land transportation facilities will increase due to delivery of construction materials to the site, filling or site preparation, and movement of the construction work force to and from the site. During operation, truck and/or automobile traffic will be generated in general proportion to facility size and employment.

Construction of nonwater-oriented uses has the potential to generate noise impacts on nearby properties, as well as aesthetic, recreational, and historic/cultural/archaeological resources. Truck and other traffic generated by facilities operation can also contribute to ambient sound levels in the local area.

Mitigation

Nonwater-oriented industrial and commercial uses should have sufficient access to regional highway and rail systems. Connections to regional highway systems should be via designated truck routes for truck transport dependent uses to reduce proximity impacts (noise, air quality, safety) on nearby sensitive uses.

Alternatives

Alternatives associated with developing nonwater-oriented commercial and industrial uses, like other types of development, include: (1) the build/no action option, (2) alternative site options, (3) use of alternative sites suitable for nonwater-oriented uses, and (4) site design and facility options. The discussion of the first three options contained in the alternatives section for marine terminal development above is equally

relevant to this section. Site and facility design options (internal circulation, building configurations, location of internal components, routes of entry to and exit from the site) have the potential to mitigate proximity impacts imposed by such uses.

Consistency with Land and Water Use Plans and Policies

The decision to grant a permit to develop an individual project is based in part on a determination of the project's consistency with plans and policies. Federal, state, and local plans and policies that direct land and water use decisions in the study area are outlined in the COBS I report Land and Water Use (Johnston 1981).

General land and water use plans and policies provide for the concentration of similar uses in designated areas where transportation systems, utilities, and other infrastructure have sufficient surplus carrying capacity to permit development. The plans and policies recognize the need for assuring adequate supplies of land to support future development of residential, commercial, industrial, institutional, public, and other uses in an urban environment and the need for integration of such uses into urban patterns that enhance public health, safety, and welfare.

These plans and policies also include specific policies directed at protection of natural and recreational resources. Such policies seek to enhance and promote the existence of natural areas, open spaces, public use areas, shorelines, historic and cultural resources, scenic views, and other amenities.

An individual project therefore must be assessed in terms of its compliance with the principles and intent inherent in these plans and policies. A project that will conflict with major concepts established in effective land and water use plans and policies after all reasonable mitigation, design, build, and site alternatives are explored, can have serious impacts on ordered and beneficial growth and development in the study area.

6. SPECIFIC PROJECT EVALUATIONS

INTRODUCTION

This chapter provides individual descriptions of all the projects specifically identified for development in the Commencement Bay study area. Information about each project was obtained from the Corps' permit applications, when available, or from the project sponsor. In instances where no specific project information was available assumptions were made as to the nature, dimensions, timing, etc. of the project to allow evaluations to proceed. Key assumptions that have been made are included in each project description.

Each evaluation states the sponsor and the Corps application number (if applicable) and the estimated length of time to construct the project. The project description is followed by a discussion of anticipated impacts to the natural and human environment. In these discussions the level of significance assigned in each resource area to each project is provided along with a brief statement about rationale behind this assignment. The reader should keep in mind that these significance levels differ from assignments of impact magnitude (e.g., a "major" impact may be of "minimal" significance if it is of "limited" extent, "short-term" duration, and "unlikely" probability). Impacts were usually assessed as those that would occur in the absence of mitigation measures except that in assessing impacts on fish and invertebrates it was uniformly assumed that major in-water activities (dredging, filling, extensive piledriving) were conducted during the period August through February when few juvenile salmonids are present. Additional project-specific mitigation and alternatives are examined; however, the reader should also refer to the discussion in Chapter 5 on generic impacts and appropriate mitigation measures and alternatives. While internal references to Chapter 5 are presented as appropriate, the information presented in Chapter 5 is not reiterated for each individual project.

PROJECT NO. 1 HYLEBOS MARINA

Sponsor: J.E. Meaker
Development Subarea: 1
Duration of Construction: 6 months-1 year
Corps Application No. 071-OYB-1-001674; recently cancelled*

Activities: Marina construction, piledriving, dredging, filling, breakwater construction

Project Description

The sponsor proposes to develop a marina with a capacity of 308 moorages near the mouth of Hylebos Waterway. The project involves creation of about 2.6 acres of new land extending into Commencement Bay to provide parking and other onshore support for the marina facility. The marina

*Although this application was recently cancelled; development of this project in substantially the same form is still considered to be possible.

would cover nearly 10 acres of water and would extend seaward to the existing harbor line. Floating marina facilities would consist of a breakwater and pile-stabilized moorage floats and dock structures. A piling bulkhead would be constructed to contain 35,000 cubic yards of dredged materials taken from the proposed marina basin (30,000 cubic yards) and bank run materials (5,000 cubic yards) trucked from a site located 1/4 mile from the project. Dredging would deepen some 4.3 acres of shallow subtidal and intertidal habitat to -10 feet.

It should be noted that the Hylebos Marina as proposed is located approximately 250 yards north of the marina site orignally proposed by another sponsor at the mouth of the Hylebos Waterway. Therefore, unlike the latter proposal, this proposal would not result in the destruction of the salt marsh located on the north shore of the Hylebos Waterway at its mouth.

Impacts

Natural Environment: The major construction impact would result from dredging and filling approximately 7 acres of intertidal-shallow subtidal mudflats, including approximately 4 acres of intertidal beach and important mudflat habitat, at the mouth of Hylebos Waterway. Destruction of a portion of the intertidal wetland (beach and mudflats) was evaluated as severe since this area represents part of a larger system that includes a 2.5-acre salt marsh located approximately 250 yards south of the Hylebos Marina site. Direct loss of benthic invertebrates and juvenile salmonid rearing opportunities was evaluated as moderate, as were construction impacts on migratory and resident birds. Piledriving, filling, and dredging would also create moderate short-term water quality impacts. Recent data (Malins et al. 1980, 1982; Swartz et al. 1982; Chapman et al. 1982; Isakson and Loehr 1981) indicate that sediments near the mouth of Hylebos Waterway contain organic compounds and heavy metals in concentrations exceeding EPA criteria for the protection of saltwater aquatic life.

Operation impacts were evaluated as severe to invertebrates and fish due primarily to the long-term reduction in potential rearing habitat for juvenile salmonids. Increased use of the area by nonsalmonid forage and demersal fish can be expected because of the extensive overwater structures and because of the deepening by dredging. Operation impacts on existing wetlands were evaluated as severe due primarily to the effects of a long-term loss in productivity from permanent removal of intertidal habitat, as well as the potential for contaminants (fuel/oil/sewage) associated with marina operation to spread to adjacent intertidal areas. Marina operations would impose moderate impacts to the salt marsh located to the south. Overwater structures cause minor impacts on circulation, and therefore the input of water and nutrients to the salt marsh. Marina development may cause minor exposure of the salt marsh to spilled oil and sewage. However, it should be noted that the existing Commencement Bay Marina at this mouth of the Hylebos Waterway is located only 100 yards from the salt marsh and thus likely imposes greater overall impact. Operation impacts on birds and water and sediment quality were evaluated as minimal. Some bird use of the marina area would occur and use of a floating breakwater should greatly reduce the potential for more severe water quality impacts.

Human Environment: Construction activities would intensify the use of adjacent uplands from undeveloped beach to interim use as a staging area for construction materials and equipment. Substantial temporary modification of land surface would occur as a result of heavy equipment operations. Some additional construction-related traffic would be generated along approach arterials; however, due to rapid dispersion along the connecting road systems, this impact would be relatively minor. Similarly, vessel traffic at the mouth of Hylebos Waterway would increase due to construction activities such as breakwater and dock construction and piledriving. Most of this activity would occur outside of prescribed navigational channels; however, the potential for conflict with larger vessels entering and departing Hylebos Waterway would increase by a minimal amount.

Construction activities would limit public access to the site. Construction-related noise emanating from the site would be severe at times due to piledriving and heavy equipment operation; however, high noise levels would be temporary. Construction activities would result in a temporary reduction in the aesthetic quality of the area.

During operation, the project would result in long-term conversion of land use from open, undeveloped beach and uplands to more intensive recreational and commercial use. While such development in a previously developed area would not impose major land use impacts, the elimination of beach and tideflats for commercial/recreational use resources does not fully comply with policies contained in the City of Tacoma Land Use Management Plan (Tacoma Citizens' Land Use Policy Advisory Committee 1975) and the Northeast Tacoma Plan (Tacoma Planning Commission 1979). Such an action would require a change in existing zoning. The marina would greatly increase the potential for vessel accidents by introducing large numbers of recreational vessels (up to and perhaps exceeding 350 per summer peak day) into the shipping channels approaching Hylebos and Blair waterways. The proximity of the designed breakwater entrances and exits to the marina to designated navigational channels would not permit sufficient distribution/dilution in recreational vessel traffic volumes prior to intrusion into commercial shipping lanes. Impacts on water use/navigational safety are adjudged to be severe.

The project would affect recreational resources in the area. While beach habitat currently used to a minor extent for birdwatching and beachcombing would be eliminated, net recreational use of the site (due to marina development) would increase. Aesthetic impacts would include replacement of natural habitat by marina facilities. However, the overall visual impact of the marina would be mitigated by its proximity to the port industrial area. Noise would be generated by vessels and automobiles operating in and near the marina. This noise would add incrementally to existing vehicular and boat noise near the mouth of Hylebos Waterway. Marina-associated noise would occur primarily during daylight hours and would not impose substantially higher noise levels on nearby sensitive receptors. The Hylebos Marina site has been used historically (along with the entire south shore of Commencement Bay) by Native Americans. The site (unlike most areas of the study area) is relatively undisturbed; therefore, a slight potential exists for finding relatively undisturbed cultural artifacts at the site.

Project-Specific Mitigation

The majority of generic mitigation measures related to marinas, dredging, filling, and shore treatments apply to this project. A series of interagency meetings has been held (1979) regarding mitigation options for this project. Of the options considered, replacement of the lost littoral habitat "in-kind" by creation of equivalent shallow water or salt marsh habitat nearby received the greatest acceptance. Options for this type of action are limited in Commencement Bay by existing shoreline developments and natural bathymetry. Areas off the ends of existing interwaterway "peninsulas" offer some potential (see Project No. 21) but several are committed to commercial port development requiring deepwater access. The shoreline west from the proposed marina site offers some potential for increasing the acreage of shallow habitat presumed to be favored by juvenile salmonids (especially pinks and chums) for rearing in the first days and weeks of saltwater residency. However, COBS I study results indicated higher epibenthic invertebrate densities in the mixed gravel and cobble habitat west of the proposed marina site (Station 4) than on the shallow sandy beach just east of the site (Station 3) (Blaylock and Houghton 1981). Shoreline modification by filling to create a presumably "favorable" environment for juvenile salmonids west of the project site would eliminate the existing habitat and replace the existing benthic community with a new one that may or may not increase community parameters of abundance, diversity, biomass, and species richness. Factors of substrate as well as slope and water quality must be considered in judging the potential value of a mitigation plan involving attempts to modify existing marine habitat.

Project-Specific Alternatives

The generic alternatives to wet moorages described in Chapter 5 apply. An alternative configuration of office and parking facilities might be feasible to reduce the amount of filling of lower intertidal habitat (e.g., restrict fill to MHHW and above).

PROJECT NO. 2 SOUND REFINING PIER EXPANSION

Sponsor: Sound Refining Co. Duration of Construction: Phased over
Development Subarea: 1 10 years

Activities: Overwater construction, potential concrete shore treatment, potential piledriving, filling, dredging, pier construction

Project Description

The sponsor proposes to expand an existing oil storage and distribution facility by filling some 26 acres of adjacent tideflats and salt marsh and developing additional storage capacity, a barge loading pier, and marine fueling facility. The parcel to be filled and developed consists of undeveloped intertidal and subtidal mudflats (22 acres) with a fringing wetland (3.9 acres). Alternative internal schemes, shore treatments, containment facilities, dredging techniques, and fill source are still being studied. Construction would be phased over 10 years but it is assumed for purposes of evaluation that the entire parcel would be filled

at one time and that ultimately it would be faced with a pile-supported wharf. A net loss of some 600 feet of shoreline at MHHW would result.

Impacts

Natural Environment: Project construction impacts were evaluated as severe to fish, invertebrates, and wetlands due to the filling of approximately 22 acres of intertidal and subtidal mudflats and 3.9 acres of salt marsh wetlands. The intertidal mudflats are important for benthic and epibenthic invertebrate production and juvenile salmonid rearing. The salt marsh wetland represents 37 percent of the remaining habitat of this type in the study area and is important in primary production and detrital export to adjoining marine waters (Boule and Dybdahl 1981). Loss of resident and migratory bird use of the project site was evaluated as a considerable impact. Construction impacts on water quality were rated as minimal assuming clean fill material would be used.

Operational impacts were rated severe to fish and invertebrates due to the long-term effects of habitat loss and the resulting increased pressure on remaining Hylebos Waterway and Commencement Bay mudflats for juvenile salmonid rearing. Operation impacts to wetlands were rated severe due to the long-term loss in productivity from filling the area and the potential for spills affecting adjacent mudflats. Operation impacts to birds were rated considerable and consist of a long-term feeding and resting habitat loss. Operation impacts on water quality were evaluated as considerable from the standpoint of potential increased point and nonpoint sources of inputs resulting from expanded plant operations. Since water and sediment quality in Hylebos Waterway is generally poor (Isakson and Loehr 1981; Enkeboll 1981), additional inputs would further degrade existing conditions.

Human Environment: Construction of the expanded Sound Refining facilities would result in moderate impacts to land and water use. During construction, land adjacent to the fill area would be converted to temporary use as a staging area for construction materials and equipment. Construction-related traffic would use arterials serving the site including E. 11th Street, Marine View Drive, and others. This increase in traffic would reduce the surplus capacity of these arterials; however, the increase would be relatively minor compared to existing traffic volumes. Construction would impose severe noise impacts on nearby residential uses during piledriving operations; however, construction activities are exempt from state and local noise ordinances when performed during certain periods of the day. Construction-related noise would be temporary and intermittent.

The proposed expansion of Sound Refining facilities would impose severe land use and moderate water use impacts during the life of the project. The adjacent mudflats would be converted from a productive natural environment to industrial use as a fuel storage and marine terminal. While this use is generally consistent with the industrial character of the greater port area, elimination of one of the few natural tideflats of any size remaining in the area is not consistent with certain goals and policies in the Tacoma Land Use Management Plan (Tacoma Citizens' Land Use Policy Advisory Committee 1975) and the Northeast Tacoma Plan (Tacoma Planning

Commission 1979). The facilities would generate additional vessel traffic due to expanded refueling and storage capability; it is anticipated that the size of the average vessel using the expanded berth facilities would be larger than vessels currently calling at the existing berth. However, the increase in use would not substantially affect the safety of navigation in Hylebos Waterway. Since the area supports low levels of recreational pursuits (except for occasional birdwatching), recreational impacts would be minimal. The project would contribute incremental noise to the area, but the noise would not increase ambient sound levels and would be consistent with existing noise ordinances. Operations would have little or no effect on aesthetics or the historic/cultural resources of the area.

Project-Specific Mitigation

Barge or rail transport of fill materials would reduce the impacts on local road systems due to the large number of truck trips needed to transport the required volume of fill. Mitigation of the loss of intertidal mudflats and salt marsh as in Project No. 1 would be difficult to achieve in Commencement Bay. Discussion for Project No. 1 applies.

Leaving a small shallow embayment or notch in the fill (e.g., near the E. 11th Street Bridge), decreasing the slope of the face of the fill, and reducing the length of wharf along the face of the fill would greatly increase feeding opportunities for juvenile salmonids moving out through Hylebos Waterway. The notch in the fill should be designed to enhance its circulation and provided with a mixed gravel/sand substrate to encourage growth of epibenthic crustaceans.

Best available technology for safe handling of petroleum hydrocarbons should be incorporated in the project design and operation practices to reduce the risk of spillage to the marine environment and ensure maximum efficiency of containment and cleanup of any spilled hydrocarbons.

Project-Specific Alternatives

Alternatives to accomplishing this project at this site might include a rearrangement of facilities layout to reduce the amount of area required to be filled, thus preserving some portion of the existing salt marsh and mudflat.

PROJECT NO. 3 JOHNSON DOCK

Sponsor: C.D. Johnson
Development Subarea: 1
Duration of Construction: <6 months
Corps Application No. 071-OYB-1-005905

Activities: Overwater structure, piledriving

Project Description

The applicant proposes to develop a docking facility consisting of an existing concrete pier and a new 5- x 35-foot concrete float to be used for boat engine repair work (northeast side of Hylebos Waterway). The project was started but has not been continued as the applicant is now deceased. The permit is still valid, however.

Impacts

Natural Environment: Construction impacts to study area biota and water quality would be inconsequential. Piledriving would cause short-term sediment suspension. Operational impacts would likewise be inconsequential for the biota with minor shading from the overwater structure. Minimal impacts were projected for water quality due to the existing poor water quality in Hylebos Waterway and the potential for incremental additional small fuel/oil spills during project operation.

Human Environment: Construction of the dock facility would impose land and water use impacts that are for the most part inconsequential due to its small scale and short construction period (see the discussion of impacts associated with Other Water-Oriented Uses in Chapter 5). The facilities, once constructed, would not generate substantial additional vehicular traffic, nor would they generate a change in the industrial use of the site or adjacent waterways. Operations of the boat repair facility would result in a minor increase of vessel traffic, but the increase would not substantially reduce the excess carrying capacity of Hylebos Waterway. Construction impacts would be minimal; only two piles would be driven. Operational noise (boat motors) would contribute incrementally to the existing industrial noise environment. The project would have minor or no impact on recreational, aesthetics, and cultural/historic resources.

Project-Specific Mitigation

No project-specific mitigation of impacts to the natural and human environments appears warranted. Mitigation measures proposed in Chapter 5 for piledriving and overwater structures apply.

Project-Specific Alternatives

Consideration of alternatives is not warranted.

PROJECT NO. 4 MARINE TECHNICAL SERVICES PIER AND WAREHOUSES

Sponsor: Marine Technical Services Duration of Construction: <6 months
Development Subarea: 1 Corps Application No. 071-OYB-1-006230

Activities: Overwater construction, piledriving, filling, dredging, commercial pier construction, shore treatment, pier construction, land construction

Project Description

The applicant plans to upgrade existing marine boat building and outfitting facilities on the northeast side of Hylebos Waterway through a variety of actions. A vertical bulkhead would be placed to follow the +9.4-foot contour for about 600 feet north from their existing ways. Some 2,000 cubic yards of upland fill would be placed behind this bulkhead to provide a graded storage/work area. A 500- x 40-foot pile-supported concrete pier would parallel the shoreline in front of the bulkhead in water +4 to -12 feet deep. A ramp would connect this pier to the shore.

Existing marine ways would be relocated slightly and a work float would be installed alongside the ways. Some 900 cubic yards of sediments would be dredged from the vicinity of the float and ways to provide desired clearance and grade.

Upland activities would include construction of two warehouse buildings and a roof addition.

Impacts

Natural Environment: Construction impacts were rated as inconsequential to study area birds and wetlands. A potential problem exists during piledriving and dredging from suspension of sediment-bound contaminants. Sediments adjacent to the project site contain high levels of PCBs (Isakson and Loehr 1981). Thus, effects on water quality/sediments and fish/invertebrates were rated of minimal significance. Operation effects on fish would be moderate due to the presence of a major overwater structure that may present a barrier to alongshore movement by outmigrating juvenile salmonids and reduce the value of the intertidal-shallow subtidal rearing area behind the pier. Project operation would likely have a minimal impact on water and sediment quality although longshore movement and flushing would probably be reduced slightly by the planned in-water structures. Present water quality conditions are poor in this area; chemical contaminants enter the waterway from bank seepages and reduced circulation or flushing would lengthen pollutant residence time.

Human Environment: Development of project facilities would result in relatively minor land and water use impacts. The project represents expansion of a relatively small-scale, exising water-oriented use (see discussion of impacts associated with such projects in Chapter 5). The only major impact on the human environment associated with the project results from high noise levels imposed on adjacent properties due to piledriving during construction. However, this impact would be short term and intermittent. Vehicle and vessel traffic would increase slightly in the project area due to construction and operation of the expanded services pier and marine ways.

Project-Specific Mitigation

This project does not appear to warrant project-specific mitigation. Generic measures related to vertical bulkheading and overwater structures apply.

Project-Specific Alternatives

No reasonable alternatives appear to exist that would allow comparable facilities at this site.

PROJECT NO. 5 LOUISIANA-PACIFIC LOG HANDLING FACILITY

Sponsor: Louisiana-Pacific Corp. Duration of Construction: <6 months
Development Subarea: 1 Corps Application No. 071-OYB-2-007357

Activities: Overwater construction, riprapping, and piledriving

Project Description

Louisiana-Pacific plans to improve the efficiency of their existing log handling operation in the inner turning basin of Hylebos Waterway by installing a new log bundle lift and dump assembly. The assembly would consist of parallel steel rails 12 feet apart mounted at their upper end (above MHHW) and in the middle (MLLW) on pile-supported concrete slabs. The lower end of the rails would extend to -12 feet and the bank under the ramp would be protected with a riprap blanket.

Impacts

Natural Environment: Project construction impacts on study area biota and water quality were evaluated as inconsequential to birds and wetlands and minimal to fish and invertebrates. Operational impacts were considered inconsequential to biota with the exception of a minimal impact on juvenile salmonids attempting to move along the shoreline during log dumping activities. Although existing water quality in the vicinity of the project is poor (Isakson and Loehr 1981; Riley et al. 1981), water quality impacts were evaluated as inconsequential under the assumption that the input of bark and woody debris to the waterway would not increase significantly.

Human Environment: This project entails onsite improvements to increase the efficiency of an existing industrial use. Therefore, impacts on land use would be limited to minor increases in traffic generated by ramp construction. A small number of construction support vessels would operate in adjacent areas of Hylebos Waterway to support piledriving and shore modification activities. Construction vessels would not interfere with larger vessels using the turning basin. Piledriving would impose temporary noise impacts on adjacent land uses. Operation of the ramp would not generate substantial additional vehicle or vessel traffic. While operation of the facility may add incrementally to ambient noise for the life of the project, such impacts would be minor in magnitude. Construction and operation should have no effect on recreational, aesthetic, and historic/cultural resources.

Project-Specific Mitigation

No project-specific mitigation appears warranted. General mitigation for overwater construction, riprapping, and piledriving apply.

Project-Specific Alternatives

Alternative log handling equipment at this site would not provide the desired efficiencies of the proposed project.

PROJECT NO. 6 HOOKER CHEMICAL MODERNIZATION

Sponsor: Hooker Chemical Co. Duration of Construction: Next several years
Development Subarea: 1

Activities: Internal modifications to process equipment to increase efficiency

Project Description

Hooker Chemical plans to modernize its facility gradually over the next several years, given a sound economic environment. This modernization would not increase chemical production, but would result in an improvement in overall plant efficiency.

Impacts

Natural Environment: This project does not have any activities affecting the quality of marine waters or associated biota. Neither construction nor operation activities would have any impact on water quality in the area. Thus, project impacts were evaluated as inconsequential to the natural environment of the study area.

Human Environment: Equipment and materials to improve the efficiency of the Hooker Chemical plant would be delivered by truck, rail, or vessel. Existing transportation facilities have sufficient surplus capacity to accommodate phased delivery over a number of years. No appreciable impacts to any element of the human environment are anticipated as a result of this project.

Project-Specific Mitigation

No project-specific mitigation is warranted by this project.

Project-Specific Alternatives

Not considered.

PROJECT NO. 7 BLAIR WATERWAY DREDGING AND BRIDGE REPLACEMENT

Sponsor: Port of Tacoma/ Corps of Engineers
Duration of Construction: >1 year
Development Subarea: 2

Activities: Dredging, land construction, overwater construction, pile-driving, offsite placement of dredge materials

Project Description

As part of the Blair-Sitcum waterways project, Blair Waterway would be dredged to a depth of 45 feet over its entire 2.6-mile length. Channel side slopes for both waterways would be 1 foot vertical to 3 feet horizontal. In total, an estimated 2.5 million cubic yards would be removed from a bottom area of approximately 250 acres. Materials dredged from Blair Waterway during this dredging cycle would be used to fill Milwaukee Waterway to support development of a containerized cargo terminal. Impacts associated with placement of dredged materials as fill in Milwaukee Waterway are assessed under Project 21. General impacts associated with placement of dredged materials are discussed in Chapter 5. The impacts associated with future maintenance dredging cycles in Blair Waterway is not assessed in this project analysis.

This project also includes the replacement of the E. 11th Street Bridge over the Blair Waterway with a high-level bridge structure allowing 300 feet of vertical clearance.

Impacts

Natural Environment: Water and sediment quality are major concerns in this project. Bioassay results (Swartz et al. 1982) indicate a high degree of patchiness in sediment toxicity. Survivorship ranged from 0 to 20 organisms (20 being the highest) with lower survival rates in the vicinity of Lincoln Avenue. Chapman et al. (1982) also reported variation in presence or absence of significant sublethal effects to test organisms throughout the waterway. Dredging could cause a resuspension of contaminants and a potential dispersion to other areas of the study area. Construction impacts would be severe to fish and invertebrates due to direct loss of organisms and indirect reductions in water quality. Inconsequential impacts would be imposed on wetlands. Disturbance impacts on birds would be moderate during construction.

Operation impacts on water and sediment quality were evaluated as moderate. Sediments should be cleaner and flushing greater after dredging but the level of vessel activity would probably increase, resulting in a greater occurrence of accidental spills and discharges entering the waterway. Operation impacts were evaluated as inconsequential to wetlands. Minimal impacts to birds, fish, and invertebrates were projected with a likely improvement in health of the benthic community and demersal fish.

Human Environment: Construction would impose moderate impacts on land use. Overland transport of dredged materials for use as fill constitutes the major land use impact imposed by dredging Blair Waterway. As indicated in the project description above, it is assumed that dredged material from the outer three-quarters of Blair would be used to fill Milwaukee Waterway. Fill material dredged from Blair Waterway would be transported overland to the fill site via a pipeline approximately 1 mile in length. Construction of the pipeline would impose temporary land use impacts such as disruption of local traffic, potential interference with other land uses, and conversion of land use on the short-term basis from other uses to use as a transportation corridor. The extent and magnitude of such impacts would depend on the pipeline corridor selected. If dredged materials from the landward one-quarter of the waterway are disposed upland, disposal would be via either truck or pipeline. If truck transport is selected, truck traffic would increase along road segments between Blair Waterway and the selected disposal site. Selection of the pipeline option would result in impacts similar to those discussed for pipeline development above. Construction of the high-level bridge would result in some relocation of existing uses and rerouting of local roads in the bridge area (not unlike that required when the bridge is out of operation due to vessel collision!).

Water use impacts associated with the Blair Waterway dredging project would be considerable. Such impacts would include increased vessel traffic in Blair Waterway and Commencement Bay due to the movement and positioning of waterborne dredges and support vessels. Dredging operations in navigational channels in Blair and its approaches would potentially interfere

both with other marine shipping and recreational boating using the waterway. Open water disposal of dredge spoils would result in incremental increases in vessel traffic in Commencement Bay. Project construction would impose noise impacts evaluated to be severe in significance due to dredging and filling operations.

Dredging of Blair Waterway would facilitate navigation in the waterway and would enhance the development of adjacent lands for water-oriented uses along its 2.6-mile length. To the extent that dredging hastens such development through infilling and redevelopment, project operation would in turn hasten the reduction in surplus capacity for both overland and water transportation systems serving lands either located along or dependent on Blair Waterway, resulting in moderate land and water use impacts. The replacement of the Blair Waterway Bridge with a high-level bridge would facilitate traffic flow along E. 11th Street and connecting arterials and reduce the risk of future bridge-vessel collisions.

Operation of dredged Blair Waterway would impose minimal or no noise, aesthetic, recreational, and historical/cultural impacts.

Project-Specific Mitigation

Careful study of available disposal sites must be conducted to assure efficient disposal of dredged materials while maximizing use of the uncontaminated materials to improve upland sites suitable for development and protect sensitive upland habitats. Clean material could also be incorporated into mitigation actions for other projects--e.g., in creation of shallows or islands.

Project-Specific Alternatives

Alternatives to high-level bridge construction include development of alternative arterial construction between the Tacoma Central Business District, the port industrial area, and northeast Tacoma. Alternatives to the assumed dredging mode (suction) are less desirable environmentally.

PROJECT NO. 8 TOTE RELOCATION AND FINGER PIERS

Sponsor: Port of Tacoma
Development Subarea: 2
Duration of Construction: 6 months
Corps Application No. 071-OYB-2-008546

Activities: Piledriving, riprapping, dredging, pier construction

Project Description

To accommodate development of a containerized cargo terminal at Milwaukee Waterway, the Port of Tacoma plans to develop a new wharf complex along the northeast shoreline of Blair Waterway to be used by TOTE. This project would consist of three finger piers and another small offshore pier, all pile supported. Piers would have a working depth of -40 feet of water achieved by clamshell dredging of some 270,000 cubic yards from existing submerged lands (3.6 acres) and uplands. Some 2.9 acres of new marine habitat at -40 to MHHW would be created. Dredged material would be disposed of at a deepwater site in Commencement Bay.

The piers would occupy a total of 180 feet of shoreline spaced over about 700 feet. Mooring dolphins would flank the outermost piers and be linked to them by catwalks. A riprap blanket would span the project area (900 feet at MHHW). Three 30-inch storm drain outfalls would be installed to improve upland drainage. Each would have a concrete splash box and riprapped apron.

Impacts

Natural Environment: Construction impacts would be inconsequential for birds and wetlands and minor for fish and invertebrates due to destruction of existing berths. Although some intertidal acreage would be lost, a roughly equal amount would be created through construction and thus offset the loss. Construction impacts on water and sediment quality were judged to be moderate; the material to be dredged is primarily marine sediment previously placed as fill. Most impacts would occur from siltation and turbidity during the dredging operation. A permit has been obtained for open-water disposal. Operations impacts were judged to be moderate to fish due to possible interference with juvenile salmonid movement around the piers and inconsequential to other biota and wetlands. Water quality impacts from project operation were considered moderate because of the possibility of spillage of handled cargo and possible effluent from ships at the wharf.

Human Environment: Development of a containerized cargo terminal in Blair Waterway would introduce land and water use impacts similar to those described under the discussion of marine terminal impacts in Chapter 5. The general land and water use characteristics of the area would not change. Use of land and water transportation systems near the site would increase moderately. However, since this project supports the relocation of an existing use from Sitcum Waterway to Blair, impacts on regional land and water transportation systems would be minimal. Construction noise would be severe due to piledriving and dredging activities, although this impact would be short term and intermittent. Noise associated with operation of the TOTE facilities would not increase ambient sound levels substantially. Construction and operation impacts would have no impact on aesthetic, recreational, and historic/cultural resources.

Project-Specific Mitigation

Generic mitigation measures for overwater structures apply (e.g., use of steel grating sections at shoreward end of piers). Construction water quality impacts of the dredge site would be reduced by using hydraulic versus clamshell dredging. Some improvement to road and rail connections to regional transportation systems may be required to assure efficient levels of service and movement of cargo crossing the terminal.

Project-Specific Alternatives

Several site options have been discussed for the TOTE relocation including sites located further landward on Blair Waterway, sites in the Port of Tacoma Industrial Yard, and other locations of suitable size with good water access. Since the level of impact associated with siting the TOTE

facility at the outer Blair site assessed herein is generally minimal to moderate for all elements of the environment, only modest benefits at best would be realized by an alternative site. Analysis of alternative sites must focus on impacts to biota resulting from incremental degradation of already severely degraded water and sediment quality conditions. The location of a water-oriented use of this magnitude further landward in a given waterway would increase a vessel's exposure time to navigational hazard, increasing the potential for vessel accident. Siting of such a facility would also require the upgrading of existing local land transportation systems to provide necessary connections with regional systems.

PROJECT NO. 9 PIERCE COUNTY TERMINAL BERTH

Sponsor: Port of Tacoma Duration of Construction: 6 months
Development Subarea: 2

Activities: Piledriving, riprapping, dredging, filling, pier construction, land construction

Project Description

The Port of Tacoma plans to construct a third berth at the Pierce County Terminal to accommodate vehicle imports displaced by anticipated increases in break-bulk cargo movements across existing terminal berths. The new berth would be approximately 900 feet in length by 100 to 150 feet wide covering about 2.5 acres (900 x 125 feet assumed). It was assumed that dredging an area 50 by 900 feet would be required and that the slope under the pier would be protected from erosion by riprap shore treatment. An additional 35 acres would be developed onshore for vehicle storage.

Impacts

Natural Environment: Construction impacts on fish and invertebrates are rated as minimal due to minor habitat loss and disturbance. Construction on upland areas could potentially include development of a portion of a freshwater wetland complex described in Boule and Dybdahl (1981); therefore, wetland impacts are ranked as moderate. Assuming development of a portion of the wetlands, construction impacts on birds would also be moderate since the habitat lost is important to a number of species for feeding, nesting, and resting. Water quality impacts during construction would be minimal; some short-term sediment suspension would result from piledriving and several studies have shown moderate levels of organic pollutants in the sediments (Malins et al. 1980, 1982) as well as significant sublethal effects to test organisms (Chapman et al. 1982).

Operations impacts were rated moderate to fish and invertebrates and include loss of productivity under overwater structures and possible interference with juvenile salmonid movement around the piers. Operations impacts were rated minimal to wetlands and birds since the major impact occurred during construction and no further wetland habitat would be lost through operation. Operations impacts to water and sediment quality would be inconsequential.

Human Environment: Construction of the berth facilities would result in an increase in use of local land and water transportation systems (delivery of materials, dredging and piledriving, transport of dredge/fill materials). Construction-associated noise would be high; however, noise impacts would be temporary and intermittent and would affect few adjacent uses due to the relatively undeveloped character of the immediate area. The project would result in minimal or no impacts on aesthetic, recreational, and historic/cultural resources.

The third berth at the Pierce County Terminal would represent an expansion of an existing land and water use. The berth would expand the cargo handling capability and capacity of the terminal and would result in the relocation of the offloading of imported vehicles from the existing terminal berths to the new berth. Therefore, a net increase in cargo handling capability would accrue from the additional break-bulk cargo handled at the existing terminal berths and any efficiencies achieved in overall cargo handling at the terminal.

Operation would result in a moderate increase in vehicular and vessel traffic (less than three vessels per week) at the terminal. Increased cargo handling activities at the terminal would add incrementally to sound levels at the adjacent sites, but noise levels and quality would be consistent with the existing sound environment. The project would impose no impacts on aesthetic, recreational, and historic/cultural resources in the area.

Project-Specific Mitigation

Generic mitigation actions for dredging and overwater structures apply. Connections between the expanded terminal facilities and existing terminal facilities and local and regional transportation systems should be adequate to accommodate increased cargo handling capacity. Onsite storage areas should also be adequate to permit regulation of cargo movement from the site to promote efficient levels of service for local transportation systems. Improved transportation facilities must be developed on a not-to-interfere basis with the adjacent wetlands.

Project-Specific Alternatives

Alternative locations for the pier and vehicle storage yards would not offer the anticipated efficiency of the proposed facility.

PROJECT NO. 10 PIERCE COUNTY TERMINAL BERTH A AND B EXTENSION

Sponsor: Port of Tacoma Duration of Construction: <6 months
Development Subarea: 2

Activities: Piledriving, pier construction, shore treatment

Project Description

The Port of Tacoma plans to extend the existing Pierce County Terminal at the head of Blair Waterway by 100 feet to improve cargo handling flexibility. An area of some 0.34 acre would be shaded by the expansion.

It has been assumed that the expansion would be a pile-supported structure. Some shore treatment might be applied under the pier.

This project would conflict with Project No. 11, requiring some modification of one or both projects to allow both to be accomplished.

Impacts

Natural Environment: Construction impacts would be inconsequential to study area biota and water and sediment quality with only minor disruption associated with piledriving. Operation impacts would be minimal to fish and invertebrates due to a minor decrease in benthic production under the overwater structure and inconsequential to other biota. Operations impacts to water and sediment quality would be minimal. Circulation and dispersal in the project vicinity would probably be somewhat reduced by the presence of pilings.

Human Environment: Construction would have moderate to minimal impacts on land and water use. Some vehicular and waterborne construction traffic would be generated along local access roads and waterways; however, these increases would result in little regional transportation impact due to dispersion. Piledriving during construction would create relatively high noise levels. However, relatively few piles wil be driven and the duration of piledriving activities would be short. Piledriving noise should not affect sensitive noise receptors, and therefore is assessed as only moderate. Facility operation would result in no real change in land or water use in the area. The expanded berth and wharf facility would result in more efficient movement of cargo and perhaps the capability to handle new cargo types. The expanded terminal would not generate substantial additional vehicular and waterborne traffic; however, the types of vessels serving the facility may change.

Neither construction nor operation would impose adverse impacts on aesthetics, recreational, or historical/cultural resources.

Project-Specific Mitigation

No mitigation appears warranted, although use of a steel grate decking would reduce the minor effect of shading on benthic productivity. If Project 11 and this project are to be developed, the design of one or both projects must be coordinated to reduce potential interference between the toe of the fill associated with Project No. 11 and site navigation of the vessels using the expanded berth facilities.

Project-Specific Alternatives

A shorter pier extension might partially achieve the intent of the project while minimizing conflict with Project No. 11.

PROJECT NO. 11 FIFE STORM DRAIN AND OUTFALL

Sponsor: City of Fife
Development Subarea: 2
Duration of Construction: Unknown
Corps Application No. 071-OYB-2-007016

Activities: Filling, shore treatment, piledriving

Project Description

The City of Fife proposes to improve its existing storm drain outfall in the southwest corner of the inner turning basin of Blair Waterway. Two lines (48- and 54-inch) would be installed running from a pump station over an enlarged dike through an outlet works consisting of a pile-supported splash pad and tide flap gate. About 4,000 cubic yards of clean fill would be placed between MHHW and -10 feet to protect the outlet structure.

This project would conflict with Project No. 10, requiring some modification of one or both projects to allow both to be accomplished.

Impacts

Natural Environment: Construction impacts would be inconsequential to study area biota and to water and sediment quality with only minor disruption by construction activities. Operations impacts would be minimal to fish and invertebrates based on the minor habitat loss and the possible effect of lowered salinity and increased turbidity from storm-water runoff. Operations impacts would be inconsequential to wetlands, birds, and water and sediment quality.

Human Environment: Construction and operation of the storm drain would impose only minimal (if any) land and water use, noise, aesthetics, recreational, and historical/cultural impacts. The project would not change existing land use and would not generate significant vehicular or waterborne traffic.

Project-Specific Mitigation

No project-specific mitigation other than generic mitigation for placement of fill, shore treatment, and piledriving discussed in Chapter 5 appears warranted.

Project-Specific Alternatives

Alternatives to the project would merely transfer the rather minor associated impacts to another location in Commencement Bay.

PROJECT NO. 12 CONCRETE TECHNOLOGY DREDGING

Sponsor: Concrete Technology Corp. Duration of Construction: Intermittent
Development Subarea: 2 Corps Application No. 071-OYB-2-008316

Activities: Dredging

Project Description

Concrete Technology Corp. proposes to periodically dredge some 3,000 to 5,000 cubic yards of material from existing barge slips and from the base of existing loading piers to provide adequate depth and a flat bottom. Total bottom area affected would be about 0.35 acre. Dredging would be

repeated annually for 5 years for a total removal of up to 25,000 cubic yards. A barge-mounted clamshell would be used with disposal proposed at a deepwater site (Fourmile Rock) in outer Elliott Bay.

Impacts

Natural Environment: Construction impacts on study area biota would be inconsequential with the exception of a moderate impact on fish and invertebrates due to direct destruction of benthos and the possible release of sediment-bound contaminants during dredging. Water and sediment quality impacts were rated as minimal. Swartz et al. (1982) had high survivorship in sediments offshore from the project site so there may not be a problem.

No operation impacts are expected since current operating levels would not change.

Human Environment: Construction and operation would impose inconsequential or no impacts on the elements of the human environment. Dredging activities would require the movement of a dredge platform along Blair Waterway and positioning in the berth for a short time each year. However, this would result in only minor intermittent impacts on water use and navigational safety.

Project-Specific Mitigation

No project-specific mitigation appears warranted; generic measures for dredging apply.

Project-Specific Alternatives

No alternatives appear feasible that would allow the desired use of the existing facility.

PROJECT NO. 13 PORT OF TACOMA TERMINAL 4 EXPANSION AND DREDGING

Sponsor: Port of Tacoma
Development Subarea: 2
Duration of Construction: Intermittent
Corps Application No. 071-OYB-2-008421

Activities: Dredging, shore treatment, piledriving, pier construction

Project Description

As part of the long-term Comprehensive Development Plan for facilities modernization, the Port of Tacoma proposes to extend the existing pile-supported pier at Terminal 4 by 300 feet (west-northwest). The pier extension would shade less than 1 acre of marine habitat, much of which is relatively shallow (<-2 feet) at the present time. Access to the pier face would be enhanced by dredging (58,000 cubic yards) to a depth of -50 feet. Grab bucket dredging would affect an area of about 1 acre. Material removed would be disposed of in a deepwater disposal site in Commencement Bay. Slope face under the pier would be stabilized with riprap.

This expansion of wharf size for Terminal 4 would allow it to handle one Panamax Roll-on/Roll-off (RO-RO) or container vessel and one general cargo/combination ship.

Impacts

Natural Environment: Construction impacts were rated as moderate to fish and invertebrates due to the loss of approximately 1 acre of benthic habitat and shoreline modification from natural sediments to riprap. Construction impacts to wetlands and birds were rated as inconsequential. Construction impacts on water quality were rated minimal and limited to short-term sediment suspension during piledriving and dredging activities. Sediment and water quality is generally not too bad in this region of Blair Waterway (Riley et al. 1981; Swartz et al. 1982).

Operation impacts were rated moderate on juvenile salmonids due to the long-term effects of loss of a small portion (<1 acre) of potential rearing area. Operation impacts would be inconsequential to all other biota as well as to water and sediment quality.

Human Environment: Construction of the pier extension and improved terminal would generate additional vehicular traffic to deliver workers and materials to the site and waterborne traffic to deliver materials and support construction-related activities (dredging, piledriving, inspections). Overland traffic would have some minor impacts on road and possibly rail systems close-in to the site, but would have no regional impact. Construction vessels would only use navigational channels to approach and depart the site, resulting in little or no navigational hazard. During operation, truck and automobile traffic may increase a minor amount due to increased cargo handling efficiency. The types of vessels using the site, and therefore the waterway, would change; however, volumes would not increase substantially.

Noise impacts during construction would be considerable due to piledriving and dredging activities; however, this impact would be short term and intermittent. No sensitive noise receptors would be affected. The project would impose no adverse impacts on aesthetic, recreational, or historic/cultural resources.

Project-Specific Mitigation

Loss of shallow benthic habitat could be mitigated in-kind offsite. Reduced productivity from shading could be mitigated by provision of steel grate decking on all or part of the extension. However, high cost measures do not appear warranted by the significance ratings given project impacts.

Project-Specific Alternatives

There appear to be no feasible alternatives that would achieve the desired increase in Terminal 4 wharf size without a complete reorientation of the wharf parallel to the axis of the navigation channel. Such a measure would involve removal of the existing pier completely and construction of a whole new facility. The new facility might be favorable in placing the

north end of the pier in deeper water (away from more important shallow water habitat) and in moving the south end of the pier farther away from the navigation channel.

PROJECT NO. 14 PORT OF TACOMA SLIP 2 FILL

Sponsor: Port of Tacoma
Development Subarea: 2
Duration of Construction: 6 months
Corps Application No. 071-OYB-2-007005

Activities: Filling, shore treatment, piledriving, pier construction, land construction

Project Description

As part of their long-term facilities modernization program, the Port of Tacoma plans to move the existing commercial fishing fleet moorage to the outer portion (600 feet) of Slip 2 to allow filling of the inner portion (400 feet). The filled area would allow for construction of a gatehouse at Terminal 4 and more efficient use of the container yard. The project would also include construction of a new service dock for commercial fishermen, rearrangement of the moorage layout, and additional work space for fishermen. The project (without mitigation) would result in a permanent habitat loss of about 4 acres (MHHW to about -16 feet) and a net loss of about 500 feet of shoreline. The fill slopes would be stabilized by placement of riprap.

Impacts

Natural Environment: Construction impacts were rated moderate for benthic invertebrates due to the loss of approximately 4 acres of shallow subtidal habitat and approximately 1,250 feet of existing shoreline. Impacts on other biota and wetlands were rated inconsequential. Water quality construction impacts are probably minimal assuming clean fill and riprap material would be used with fill placed behind an initially constructed berm.

Operation impacts were rated considerable for benthic invertebrates and fish as a result of the long-term effects of removing 4 acres of habitat. Fish use of the area would also likely suffer as a result of lowered benthic productivity. Operation impacts to birds and wetlands were rated inconsequential. Water quality impacts from operation were rated moderate based on expected impacts from expanded marine activities.

Human Environment: Partial filling of Slip 2 and relocation of the commercial fishing fleet moorage would generate the construction and operation impacts described generally in the Human Environment section of Chapter 5. Construction would generate vehicle and vessel traffic as described. Impact on transportation systems would depend upon the method of fill transport. Rail or barge transport would not tax existing systems as much as truck transport due to the number of trips required to move the required volume. In any case, construction impacts on land and waterborne transportation systems would be moderate. Improved efficiency of the adjacent terminal may increase the number of commercial cargo vessels calling at the facilities along with a commensurate increase in

vehicle traffic, but the increase is anticipated to be minor. It is assumed that the commercial fishing fleet would remain approximately the same size; therefore, operation would result in a minor increase in vessel traffic and minor changes in vessel mix for the life of the project, resulting in a moderate water use impact. Noise associated with construction activities (piledriving, filling) would impose severe, but temporary and intermittent, noise levels on nearby uses.

Project-Specific Mitigation

To reduce the duration of impacts on the human and natural environment in the area, it would be advantageous to construct this project simultaneously with Projects No. 15 and 16. Generic mitigative measures for filling, shore treatment, and overwater structures apply. Applicant should use clean fill or control quality of runoff from contaminated fill. Due to volume of fill required, barge, pipeline, or rail transport should be considered (if feasible) to reduce truck trips along local road systems.

The U.S. Fish and Wildlife Service (USFWS) has conducted preconstruction assessment of mitigative measures for the Slip 2 fill and development (Stout 1983). Measures recommended to the port by the USFWS include the alteration of fill slopes to result in no net loss of intertidal area between +6 and -6 MLLW (adjudged by the USFWS to be the optimum elevations for juvenile salmonid food organisms). The USFWS also recommends the placement of silty material among the riprap in the intertidal zone to stabilize fill slopes. These measures may be subjected to postconstruction assessment by the USFWS.

Project-Specific Alternatives

No feasible alternative appears to exist to achieve the desired expansion of the Terminal 4 facilities. If an alternative location were available for the commercial fishing fleet it is possible that the port would opt to completely fill Slip 2, thus increasing the loss of marine habitat.

PROJECT NO. 15 PORT OF TACOMA PIERS 1 AND 2 RETIREMENT AND SLIP 1 FILL

Sponsor: Port of Tacoma Duration of Construction: 1-2 years
Development Subarea: 2

Activities: Filling, shore treatment, pier construction, piledriving, riprapping

Project Description

As part of their long-term facilities modernization program, the Port of Tacoma plans to retire Piers 1 and 2 and fill Slip 1 on the west side of Blair Waterway near the entrance. This project would also involve filling the notch between Pier 1 and Pier 5 to partially square the end of the Blair/Sitcum peninsula. This project would be joined with Projects No. 16 and 19 to complete this "squaring" and maximize efficiency for handling containerized cargo. This project (No. 15) would result in filling of some 16 acres of marine habitat, net loss of about 3,500 feet of shoreline, and

construction of some 2.3 acres (2,000 x 50 feet) of pile-supported overwater structure. Riprap or vertical bulkheading would be required on some 2,400 feet of shoreline, much of it under the pile-supported wharf. Fill source is not known but may come from Blair or Sitcum maintenance dredging.

Impacts

Natural Environment: Construction impacts were evaluated as severe to fish and invertebrates, moderate to birds, and inconsequential to wetlands. The primary impact would be the loss of benthic invertebrates and benthic and pelagic habitat from filling approximately 16 acres of shoreline. Seasonal use of the log rafting area at the head of the interwaterway peninsula between Blair and Sitcum waterways by gulls and terns would be eliminated by project construction. Water and sediment quality impacts were rated moderate during construction due to the resuspension and circulation of fill material over a fairly large area as well as effects during pile and pier removal.

Operation impacts on fish and invertebrates were rated severe, including the long-term effects of benthic and pelagic habitat loss, reduction in juvenile salmonid rearing opportunities, and potential inhibition of juvenile salmonid movement around the head of the interwaterway peninsula. Operation impacts to wetlands and water and sediment quality were rated inconsequential while operation impacts on birds were rated minimal due to the long-term loss of resting habitat.

Human Environment: The filling of Slip 1 would generate the construction impacts described for fill projects in the Human Environment section of Chapter 5. Construction would increase vehicular and vessel traffic in the area, although this increase would impose only moderate impacts on existing systems. The project would modify the fill source through extraction of fill materials, either enhancing or decreasing its potential for future development. Construction noise would impose severe impacts on nearby receptors due to filling activities.

Once filled, newly created lands would support the development of industrial uses consistent with existing uses. Vehicular traffic may increase moderately to support development of a proposed bulk cargo terminal at the site, but the net increase in vessel traffic at the former Slip 1 facility would be minimal. Operation noise associated with the use of the newly filled area would not add to existing sound levels. Construction and operation would impose only minimal (if any) impact on aesthetics, recreational, and historic/cultural resources in the area.

Project-Specific Mitigation

The filling of Slip 1 should be performed concurrently with the partial fill of Slip 2 (Project No. 14) and Pier 5 fill (Project No. 16) to reduce the time that the natural environment is exposed to adverse impacts associated with filling activities. Concurrent filling would also reduce the duration of impacts on land and water use transportation systems. Generic mitigative measures for filling, shore treatments, and overwater structures apply.

Project-Specific Alternatives

No feasible alternatives appear to exist that would accomplish the port's desired modernization of outer Blair Waterway. Partial completion of the package (Project Nos. 14-16) would not fully achieve the desired efficiencies of berthing and cargo handling.

PROJECT NO. 16 PORT OF TACOMA PIER 5 FILL

Sponsor: Port of Tacoma Duration of Construction: <6 months
Development Subarea: 2

Activities: Filling, shore treatment

Project Description

As part of their long-term facilities modernization program, the Port of Tacoma plans to fill the slip adjacent to Pier 5 on the west side of the entrance to Blair Waterway. This project would be tied in with Project Nos. 15 and 19 to square the end of the Blair-Sitcum peninsula and provide additional open space for storage and handling of cargo. The fill would cover about 1 acre of marine habitat and remove about 1,200 feet of existing shoreline within the slip. It is assumed that development of the Pier 5 area would require relocation of the United Grain Terminal.

Impacts

Natural Environment: Construction impacts were rated moderate to benthic invertebrates and fish due to the loss of organisms inhabiting approximately 1 acre of subtidal habitat and 1,250 feet of shoreline. Construction impacts on birds, wetlands, and water quality were rated inconsequential.

Operation impacts were rated inconsequential to birds, wetlands, and water and sediment quality. Operation impacts were rated minimal to fish and benthic invertebrates due to the long-term effects of benthic habitat and shoreline loss.

Human Environment: Construction and operation impacts on the human environment would be essentially the same as those imposed by Project No. 15. The area to be filled is much smaller than for the Slip 1 fill; therefore, the number of vehicle and vessel trips required to support construction and operation would decrease proportionally. Operations would impose moderate impacts on land use. The general use of the Pier 1 and 5 area for terminal use would not change. This and adjacent fills would create a large contiguous open area that, once developed as a bulk cargo terminal, would permit more efficient cargo handling and storage. Specifically, development of Pier 5 would require relocation of the onsite grain terminal and conversion to use as a break-bulk cargo terminal for the life of the project. Improved efficiency of cargo handling may generate additional vessel and vehicle traffic supporting terminal operations; however, this increase is expected to impose only a minimal to moderate impact on the carrying capacity of local transportation systems.

Construction noise impacts are rated moderate for this project. Operation should have no impact on noise levels. Both construction and operation would impose only minimal to no impact on aesthetics, recreational, or historic/cultural resources.

Project-Specific Mitigation

This project should be developed concurrently with Project Nos. 14 and 15 (see discussion of mitigation for Project No. 15).

Project-Specific Alternatives

See alternatives for Project No. 15.

PROJECT NO. 17 PORT OF TACOMA BERTH D, TERMINAL 7 EXTENSION

Sponsor: Port of Tacoma Duration of Construction: 6-12 months
Development Subarea: 3

Activities: Overwater structure, shore treatment, piledriving, filling, pier construction

Project Description

The Port of Tacoma plans to construct an extension to Berth D, Terminal 7 at the east corner of the entrance to Sitcum Waterway. This extension would provide an additional 900 feet of berthing space. For the purpose of analysis it has been assumed that this extension would wrap around the end of the Blair-Sitcum peninsula and connect with Project No. 15, completing the "squaring" of this peninsula. It was also assumed that this project would include filling, shore treatment, and a pile-supported wharf structure as in Project No. 15. It was assumed that filling would occupy some 2.5 acres of existing benthic habitat and that an overwater wharf would shade about 1 acre of water surface (900 x 50 feet).

Impacts

Natural Environment: Construction impacts were rated moderate to fish and invertebrates and inconsequential to birds and wetlands. Construction would involve the loss of benthos in approximately 2.5 acres of bottom and 1,100 feet of shoreline, thereby reducing productivity of the area. Water and sediment quality impacts were rated moderate during construction. Piledriving would cause a short-term suspension of sediments; any toxicants present in the sediments would then be available for biouptake or redistribution to adjacent areas. Malins et al. (1980) report high concentrations of certain heavy metals in Sitcum Waterway sediments near the site.

Operation impacts were rated considerable to fish and invertebrates resulting from the long-term loss of benthic habitat, juvenile salmonid rearing habitat, and adverse effects on juvenile salmonid migration from the presence of overwater structures adjacent to deep water. Operation impacts were rated inconsequential to birds and minimal to wetlands and water and sediment quality.

Human Environment: Construction would impose moderate impacts on land and water use. Use of local land and water transportation systems would increase due to construction-related traffic. Construction vessels may interfere to a minor degree with commercial vessel traffic in the waterway. Piledriving and filling operations would impose moderate noise impacts on nearby industrial uses; however, noise levels would not increase appreciably due to the relative nonsensitivity of nearby land uses and the temporary and intermittent nature of the noise generated.

Operations would impose moderate land and water use impacts. Land and water use would not change appreciably, but the new berth would generate additional vessel trips (estimated at 1 to 3 per week) and an associated increase in cargo and employment at the facility. This would result in a moderate increase in water and land transportation systems. Operation noise would increase incrementally and would have a moderate impact on ambient sound levels.

Construction and operation would impose minimal or lesser impacts on the aesthetic, recreational, and historic/cultural resources in the area.

Project-Specific Mitigation

Generic mitigation measures related to filling, shore treatment, and overwater structures apply. In-kind replacement of the 2.5-acre lost benthic habitat may be explored as mitigation. No further project-specific mitigation appears warranted.

Project-Specific Alternatives

There appear to be no feasible alternatives that would provide the flexibility and cargo handling efficiency desired by the port.

PROJECT NO. 18 SITCUM WATERWAY SHOAL DREDGING

Sponsor: Port of Tacoma
Development Subarea: 2
Duration of Construction: <6 months
Corps Application No. 071-OYB-2-006837

Activities: Dredging

Project Description

The Port of Tacoma proposed this action to remove a shoal at the entrance to Sitcum Waterway to provide a nominal 35-foot depth over the entire waterway width. Approximately 3 acres of bottom would be dredged with preproject depths ranging from about -28 to -35 feet. The plan is to clamshell the material to a barge for transport to a deepwater disposal site in Commencement Bay.

Impacts

Natural Environment: Construction impacts were rated moderate to benthic invertebrates due to the loss of approximately 3 acres of subtidal habitat by dredging. Construction impacts on birds, fish, and wetlands were rated inconsequential. Construction impacts on water and sediment quality also

would be inconsequential and open-water disposal of dredge spoils has been approved by the EPA.

Operation impacts would be minimal to inconsequential for all biota and wetlands. Water and sediment quality operation impacts are minimal; circulation and flushing should be enhanced by dredging although a larger number of vessels would probably use Sitcum Waterway, increasing the occurrence of accidental spills.

Human Environment: Dredging of the shoal at the entrance to Sitcum Waterway would improve navigational safety in the waterway and would facilitate vessel approaches to terminal facilities in the waterway. Operation of the dredged waterway would have no direct impact on land use, but would enhance the potential for safe operation of a major container cargo terminal proposed for the waterway. Maintenance dredging activities would impose minimal land use impacts due to minor increases in vehicular traffic on local roads and overland transport of dredged materials. Dredging would also impose moderate temporary increases in noise levels; however, no sensitive receptors would be affected. Dredging and operation of the dredged waterway would impose little or no impact on aesthetic, recreational, or historic/cultural resources in the area.

Project-Specific Mitigation

No project-specific mitigation is warranted.

Project-Specific Alternatives

No consideration of project alternatives appears to be warranted.

PROJECT NO. 19 SITCUM WATERWAY DREDGING

Sponsor: Port of Tacoma Duration of Construction: 6-12 months
Development Subarea: 3

Activities: Dredging, offsite placement of dredged materials

Project Description

This project provides for hydraulic dredging to maintain the federal navigational channel to depths of 40 feet in the outer 3,000 feet of the waterway and 35 feet in the inner 1,000 feet. Bottom width would be 300 feet and side slopes would be 3 to 1. Bottom area affected would be approximately 46 acres. Materials removed would be used to fill Milwaukee Waterway. Offsite placement of dredged materials as fill if Milwaukee Waterway is not filled is not assessed under this project. The filling of Milwaukee Waterway is discussed below (Project No. 21) and is the subject of a federal environmental impact statement, currently under preparation.

The disposal of materials dredged from Sitcum Waterway during future maintenance dredging cycles is not assessed in this project analysis.

Impacts

Natural Environment: Construction impacts to wetlands and birds could be severe if any dredged material disposal or stockpile occurs in upland wetland habitats. Construction impacts on benthic invertebrates and fish were rated severe due to the loss of organisms inhabiting approximately 46 acres of bottom and a major disruption of existing fish populations. Water and sediment quality construction impacts were rated considerable. High levels of heavy metals (copper and zinc) have been measured in mid-waterway sediments (Isakson and Loehr 1981; Malins et al. 1980) and mixed results were obtained in bioassay testing (Swartz et al. 1982; Pierson et al. 1983). Dredging operations would cause a short-term release and dispersal of these contaminants to other areas of the waterway.

Operation impacts could be considerable to wetlands if wetlands are used as dredge disposal or stockpile areas. A long-term decrease in productivity and loss of habitat for birds would be the primary effect of disposal on wetlands in the study area. Operation impacts on water and sediment quality are difficult to evaluate. Sediments left after dredging should be cleaner than existing ones and a deeper bottom would cause greater dilution of contaminant inputs, yet increased vessel traffic would result in a greater incidence of spills. Overall, the impact would probably be minimal. Operation impacts were rated minimal to invertebrates and fish once recolonization has taken place. An overall healthier benthic community would develop in cleaner sediments after dredging.* The natural impacts associated with placement of dredged materials as fill in Milwaukee Waterway is discussed under Project 21 below.

Human Environment: Impacts on the human environment generated by maintenance dredging of Sitcum Waterway would be similar to dredging impacts described under the Human Environment in Chapter 5 and for Project No. 7 (Blair Waterway Dredging and Bridge Replacement). During construction (actual dredging), traffic would increase incrementally along local arterials; the magnitude and extent of this impact would depend on the method of dredged materials transport and its destination. Conflicts may occur between commercial and recreational vessels and dredging platforms operating in the navigational channels. These impacts are anticipated to be moderate due to a relatively short period of dredging and size of the area available for safe navigation. Dredging noise would impose only moderate noise impacts on nearby properties due to the relatively short period of dredging, the use of quiet equipment, and relatively high ambient sound levels (U.S. Army Corps of Engineers, Seattle District 1977).

Operation of the dredged facilities would have little or no adverse impacts on the human environment. Cargo handling activities at existing and future water-oriented land uses would benefit from improved channel depths and widths. Additional use of land transportation systems and the waterway and its approaches may occur due to the effectiveness of these improvements in promoting or enhancing future water-related development or increasing efficiency of cargo handling in Sitcum Waterway. Project-generated construction and operation impacts would impose no adverse impacts on recreation, aesthetic, or historic/cultural resources.

*If indeed the sediments were cleaner.

Project-Specific Mitigation

No project-specific mitigation other than generic measures described in Chapter 5 for dredging appears warranted. Suitable dredge materials could be incorporated into mitigation actions for other projects (e.g., creation of shallows and wetlands).

Project-Specific Alternatives

Alternatives to this dredging would result in reduced water depth in Sitcum Waterway and limit the size range of ships that could enter the waterway.

PROJECT NO. 20 PORT OF TACOMA WHARF

Sponsor: Port of Tacoma Duration of Construction: >6 months
Development Subarea: 3

Activities: Pier construction, piledriving, potential filling, potential shore treatment

Project Description

The Port of Tacoma proposes to construct a wharf on the west side of Sitcum Waterway to provide berthing facilities for containerized cargo vessels. This wharf is part of a proposed cargo container terminal to be developed on Sitcum Waterway and lands to be created by filling Milwaukee Waterway and Parcel 5 to the south (see Project Nos. 21, 22, and 23). For the purposes of this evaluation, the wharf is assumed to be approximately 1,600 feet long and 100 to 200 feet wide. The wharf generally would be pile supported; however, some fill may be required (about 20,000 cubic yards) to accommodate required bottom slopes. No dredging is anticipated.

Impacts

Natural Environment: Construction impacts were rated moderate to fish and invertebrates based on the loss of about 2 acres of benthic habitat and 1,600 feet of shoreline. Construction impacts on wetlands and birds were rated inconsequential. Water quality impacts were rated minimal, assuming clean fill is used. Results from bioassay and water quality studies indicate reasonably good conditions near the project site (Swartz et al. 1982; Malins et al. 1980).

Operation impacts were rated as moderate to fish and invertebrates, consisting of the long-term effects of a small habitat loss and shading of some 3.7 acres (100 x 600 feet) with resulting lowered productivity. Construction impacts on water quality, sediment quality, birds, and wetlands were rated inconsequential.

Human Environment: Wharf construction would generate moderate land and water use impacts. Land use impacts would result from the delivery of construction materials and equipment overland by access roads and rail facilities and increased vehicular traffic along nearby arterials (e.g., construction worker automobiles, truck traffic) necessary to support

construction activities. Some materials may be delivered by barge, causing a slight increase in vessel traffic. Piledriving operations may involve barge-mounted equipment. Increases in overland and waterborne traffic would not be sufficient to impose substantial impacts on access arterials or waterways; however, construction-related traffic would create a potentially greater accident hazard and would incrementally reduce the surplus capacity of existing transportation systems over the relatively short construction period (6 to 9 months). Construction would impose moderate noise impacts due to piledriving, possible filling, and other construction activities.

Operation of a containerized cargo berth and wharf facility would impose considerable impacts on land and water use for the life of the project. Both land and water use would intensify, although the general use of the site and environs would remain essentially the same. The proposed wharf is generally consistent with existing land use and coastal zone plans and policies, which permit and encourage development of water-oriented industrial uses in the port industrial area. The wharf is part of a containerized cargo terminal that would generate substantial truck, automobile, and rail traffic. The facilities would also result in 2 to 4 trips by containerized cargo vessels per week at its two berths. These increases would represent a moderate increase over current traffic levels associated with the existing TOTE facility due to project scale. However, existing access facilities (roads and waterways) have sufficient excess capacity to accommodate increased traffic volumes and cargo movement generated by the project. Operation would impose no impact on aesthetic, recreational, and historic/cultural resources.

Project-Specific Mitigation

Generic mitigative measures for filling, shore treatment, and overwater structures apply.

Project-Specific Alternatives

It appears that alternative locations or designs (beyond the generic mitigation measures mentioned above) that would provide the desired cargo handling characteristics either: (1) are already included in other port development plans or (2) would not offer significant environmental advantages.

PROJECT NO. 21 MILWAUKEE WATERWAY FILL

Sponsor: Port of Tacoma
Development Subarea: 3
Duration of Construction: 6-12 months
Corps Application No. 071-OYB-2-6175

Activities: Filling, riprapping

Project Description

As part of their long-term plan for modernization of facilities, the Port of Tacoma proposes to fill Milwaukee Waterway to develop a containerized cargo terminal. Fill would extend beyond the mouth of the waterway some 400 feet to form a "T" shape extending from the Puyallup River to Sitcum

Waterway. The proposed fill would be derived from planned dredging of Sitcum and Blair waterways and would be placed behind a containment berm of clean granular material from upland sources. Runoff from the hydraulically placed fill would be controlled through a wier on the northeast corner of the berm. The fill would cover some 40 acres of bottom area roughly one-quarter of which is intertidal or shallow subtidal (e.g., <-10 feet deep). There would be a net loss of some 1.2 miles of shoreline. Unused piers and warehouses along the west side of the waterway have already been removed. NEPA and SEPA environmental impacts statements are in preparation for this project.

Impacts

Natural Environment: Construction impacts were rated as severe to all study area biota assuming a T-shaped fill for the project as specified in the permit application to the Corps. Adverse impacts include the loss of benthos in approximately 40 acres of intertidal and subtidal habitat, some 16.5 acres of which is in shallow water (+8 to -10 feet) with considerable use by juvenile salmonids during their early outmigration period (Dames & Moore 1982). Loss of the intertidal flats at the mouth of Milwaukee Waterway would remove an important intertidal/shallow subtidal habitat for juvenile salmonid rearing, bird feeding and resting, and benthic invertebrate production. Impacts on water quality during construction would potentially be severe since proposed fill material from Blair and Sitcum waterways contains some contaminants. The runoff from the fill operation thus has the potential to redistribute contaminants in suspended sediments over a broad area.

Operation impacts were rated as severe to fish, invertebrates, and wetlands. Impacts include a long-term loss in benthic productivity due to habitat removal, loss of shallow nearshore habitat used by juvenile salmonids near the mouth of the Puyallup River, and loss of a significant proportion of the remaining intertidal mudflats in the subarea. There would be a net loss of some 6,300 feet of shoreline. Operation impacts on birds would be considerable due to a long-term loss of a high usage feeding area. Operation impacts on water and sediment quality were evaluated as moderate. If contaminated sediments are placed in Milwaukee Waterway and sealed in some manner to prevent leaching into adjacent waterways, then the long-term effects would be positive. However, if leaching of contaminated sediments occurs after fill, the long-term effects would be negative.

Human Environment: Construction impacts on land use would be considerable. The filling of Milwaukee Waterway would require the overland movement of a large volume of fill material from Blair and Sitcum waterways. Material would be transported by truck or by a hydraulic pipeline constructed between the waterways. Truck transport would have substantial impacts on the carrying capacity of local arterials and may, in fact, not be feasible due to the volumes involved. Depending upon the corridor selected for pipeline development, construction would potentially interfere with the normal operation of major arterials in the port industrial area (perhaps including E. 11th Street, Port of Tacoma Road), and/or other or existing land uses. (See discussion of dredge impacts on the human environment in Chapter 5.) This impact would be relatively short term (2 to 3 months

for pipeline construction; 12 months maximum pipeline operating time). Dredging would have moderate impact on water use. Vessel traffic would increase slightly due to dredging operations, with minor increase in the potential for vessel conflict. Construction noise impacts along the transport corridor would depend upon the method of transport use, but would be moderate at the dredge and fill sites due to the temporary and intermittent nature of construction activities and relative high ambient sound levels.

Operation impacts generated by development of a containerized cargo terminal on vehicular and vessel traffic are described under Project No. 20. The filling of Milwaukee Waterway would create 40 acres of additional land and would remove the same area from future water use. However, the general character of land and water use in the area would not change. Noise generated by project operation would be moderate. Project-associated noise would represent an incremental increase over noise impacts associated with the existing TOTE facilities near the fill site but would not change the ambient sound environment substantially. The filling of Milwaukee Waterway would eliminate an industrial waterway and create a continuous, broad peninsula causing minimal impacts to recreational activities during construction and operation. No project-specific impacts are anticipated for aesthetics or historic/cultural/archaeological resources.

Project-Specific Mitigation

Onsite, in-kind replacement of lost juvenile salmonid rearing habitat appears the best option. This would be accomplished by filling portions of the Puyallup delta previously dredged for access to Milwaukee Waterway. Other mitigation options if more are required include: offsite, in-kind replacement (building beach/shallow subtidal shoal areas elsewhere in Commencement Bay); habitat protection (purchase and preservation of existing habitat); habitat improvement (cleanup of existing degraded habitat); and understructure enhancement (involves raising the bottom under docks, etc. to shallower levels of a slope and providing surface grain size suited for invertebrate species consumed by juvenile salmonids).

Project-Specific Alternatives

Various degrees of filling from a full "T" fill to just filling Milwaukee to the end of existing peninsulas (scale differences) are the alternatives being considered. No other land under port control has the ready water access to Sitcum Waterway that the Milwaukee fill would provide.

PROJECT NO. 22 MILWAUKEE WATERWAY RAILROAD YARD PAVING

Sponsor: Port of Tacoma
Development Subarea: 3
Duration of Construction: <6 months
Corps Application No. 071-OYB-1-008374

Activities: Shore treatment, grading, paving

Project Description

As part of their long-term plan for modernization of facilities, the Port of Tacoma proposes to remove existing railyard facilities on both sides of Milwaukee Waterway and to grade and pave these areas to provide area for handling and storage of containerized cargo. Paved areas would be provided with six storm drains into Milwaukee Waterway. Storm drain outfalls would consist of a concrete splash box at MHHW with a riprap apron extending down to MLLW.

Impacts

Natural Environment: Construction impacts were rated as inconsequential to study area biota and wetlands due to the fact that no in-water activities are involved. Water and sediment quality impacts would be inconsequential as well and the project would likely have a positive effect through the act of sealing (paving) a currently dirty area (abandoned railyards) and eliminating ground water percolation into adjacent waterways.

Operation impacts would be inconsequential to birds and wetlands. Minimal impacts may occur to fish and invertebrates if runoff from the site contains contaminants; however, water and sediment quality operation impacts were rated as inconsequential.

Human Environment: This project constitutes part of the overall development of the containerized cargo terminal assessed under Project Nos. 20 and 21. Project-specific construction impacts on land and water use would be minimal to inconsequential. Traffic generated by the small work force would have little impact on the carrying capacity of local arterials. The project involves no water-based construction activities. Construction activities (grading, paving) would impose moderate increases on sound levels in the area, but no sensitive receptors would be affected.

Operation of the completed facilities would support the operation of the completed containerized cargo terminal facilities. However, project-specific impacts would have little direct impact on land and water use, noise, recreation, aesthetics, or historic/cultural resources.

Project-Specific Mitigation

No project-specific mitigation appears warranted.

Project-Specific Alternatives

Consideration of project-specific alternatives does not appear warranted.

PROJECT NO. 23 PORT OF TACOMA PARCEL 5 FILL

Sponsor: Port of Tacoma Duration of Construction: <6 months
Development Subarea: 3

Activities: Filling, land construction

Project Description

As part of the total development plan for the Milwaukee Waterway area, the port proposes to fill an area known as Parcel 5 southeast of Milwaukee Waterway across E. 11th Street. The filled area would be used for construction of buildings, parking, storage, and administrative offices to support activities at the containerized cargo handling facility. Storm drains would be incorporated to collect runoff from project facilities. Some 28 acres (including a Corps-designated wetland created by a malfunctioning tide gate) would be filled.

Impacts

Natural Environment: Parcel 5 contains a 9.6-acre wetland described in COBS I by Boule and Dybdahl (1981) as freshwater tidal marsh. Since this designation, the wetland has been reduced by approximately one-half through extensive modifications, including illegal filling, elimination of tidal influences to the wetland by repairing an existing Corps tide gate, and other site preparation activities. Restoration of the wetland to its premodification condition may be recommended by resource agencies prior to development of Parcel 5. This restoration could entail at least removal of fill and re-establishment of the tidal influence at the site to create those wetland characteristics described in Section 3.2.3 on page 14 of the COBS I Wetlands Technical Report.

Full development of Parcel 5 would eliminate all wetland characteristics associated with the site. Using the premodification characteristics of Parcel 5 as a baseline (as described in the *Wetlands Technical Report* prepared under COBS I), development of the site is considered to have severe impacts to wetlands.

Construction activities associated with this fill project are in upland areas and thus would have little or no impact on fish and invertebrates. Some minor loss of detritus to the overall Puyallup River system would occur. Construction would impose severe impacts on wetlands, due to elimination of the freshwater tidal marsh, and minimal impacts on water and sediment quality.

Operation impacts are expected to be severe to wetlands and moderate to birds based on the long-term effects of permanent removal of wetland habitat. Operation effects would be inconsequential for water and sediment quality.

Human Environment: Construction impacts would impose moderate impacts on land use in the area. Filling and upland construction would result in an increase of construction-related traffic along E. 11th Street and connecting north-south arterials. Adjacent properties and portions of Parcel 5 would be used temporarily for staging and stockpiling of construction materials. Construction would not involve use of water transport systems and therefore would have an inconsequential impact on water use. Construction activities (filling, traffic) would add incrementally to the ambient sound environment, imposing relatively high temporary and intermittent noise levels on nearby users. Noise impacts associated with project construction are rated as considerable due

to the proximity of the Puyallup River levees, which receive moderate recreational use.

Operation of Parcel 5 facilities would involve the long-term conversion of land from previously developed but vacant industrial land (with some natural amenities) to industrial use. While this level of impact is assessed as considerable due to presence of wetland resources (albeit degraded), development of the Parcel 5 facilities is generally consistent with land use plans and policies in effect for the area which call for focusing on industrial development in the port industrial area. Direct water use impacts imposed by project-specific operations would be minimal. Although Parcel 5 development supports the development of the containerized cargo terminal on Sitcum Waterway, those impacts were evaluated under Project No. 21. Operation of the Parcel 5 development would add incrementally to the existing sound environment, which is dominated by industrial noise, but would impose minimal impacts. Parcel 5 is one of several parcels specifically claimed by the Puyallup Nation under the provisions of the Medicine Creek Treaty. Negotiations may resolve this claim in favor of the port; therefore, the development of Parcel 5 would be judged to have considerable impacts on historic/cultural resources.

Project-Specific Mitigation

A complete site investigation and literature search should be performed prior to development to assure that no significant historic/cultural resources are affected by filling and upland construction. Replacement of freshwater wetlands (e.g., upstream off the Puyallup channel) may be a viable mitigation measure for this project, especially since the Parcel 5 wetland is not of the highest natural quality to begin with. The Port of Tacoma is currently conducting studies designed to determine the feasibility and value of this mitigation option. (Please see the discussion of in-kind replacement as mitigation for dredging projects in Chapter 5).

Project-Specific Alternatives

Because of the limited land area and existing uses of land in proximity to the planned Milwaukee/Sitcum containerized cargo terminal, there do not appear to be feasible alternatives that would provide the desired work area.

PROJECT NO. 24 PUYALLUP RIVER TRAINING WALL MAINTENANCE

Sponsor: U.S. Army Corps of Engineers
Duration of Construction: Intermittent
Development Subarea: 5

Activities: Piledriving, riprapping, dredging

Project Description

The Corps has an ongoing program to maintain the existing training walls and flood control levees along the lower Puyallup River. We have assumed that this is an ongoing project for the foreseeable future.

Impacts

Natural Environment: Construction impacts would be inconsequential to fish and invertebrates and minimal to wetlands and birds. Construction impacts on water and sediment quality would be minimal, consisting of short-term increases in turbidity and sedimentation through dredging and training wall maintenance.

Operation impacts would be inconsequential to study area biota, wetlands, and water and sediment quality. The project would probably result in better flushing of the lower portion of the river through removal of existing shoals.

Human Environment: Construction and operation of the training walls would have inconsequential impacts on land use (generation of minor construction traffic, use of adjacent areas to a minor extent to stockpile construction equipment). Positioning of equipment on levees may detract moderately from the aesthetic quality of the area, but such impacts would be short term. Construction activities may temporarily deny portions of the training walls from human access, creating minor recreational impacts. To the extent that construction has the potential to interfere with use of the lower Puyallup River by members of the Puyallup Nation, the project would affect historic and cultural rights to use of the river. Operation of the improved flood control facilities would impose little or no adverse impact on the human enviroment.

Project-Specific Mitigation

No mitigation appears to be warranted, other than generic mitigation proposed in Chapter 5 for piledriving, shore treatments, and dredging.

Project-Specific Alternatives

Of the feasible alternatives for flood control in the lower river (pile and plank training walls, riprapped levees, sodded levees), riprapped levees probably provide the most favorable habitat for use by outmigrating salmonids (e.g., J. Houghton, personal observations on the Skagit River, 1973 to 1976). However, it may well be that pile and plank training walls with a free-flooding (low velocity?) space between the wall and the levee behind offer comparable or better habitat.

PROJECT NO. 25 PAXPORT MILLS BULKHEAD

Sponsor: Paxport Mills, Inc. Duration of Construction: <6 months
Development Subarea: 5 Corps Application No. 071-OYB-2-006450

Activities: Riprapping, shore treatment, filling

Project Description

Paxport Mills desires to construct a concrete slab bulkhead some 620 feet in length and place fill some 25 to 35 feet in width along the shoreline of their property in Middle Waterway (east shore). Land created would be used to store sawmill waste products (bark, wood chips, sawdust) and to

construct a system to convey sawmill waste products to mill furnaces. The bulkhead would be faced with concrete rubble at a 1.5 to 1 slope to an elevation of +9.4 feet. The toe of the rubble would range from about -2 feet to +6 feet. The project would cover some 0.5 acre of existing rubble shoreline and mud bottom.

Impacts

Natural Environment: Construction impacts were rated moderate to fish and invertebrates due to substantial alteration of intertidal and shallow subtidal; approximately 0.5 acre of fairly productive mudflat would be covered by the project. While fish use of adjacent areas is relatively high (Dames & Moore 1982), bird use of the area is not known to be high. No wetlands would be affected by project construction. Therefore, construction impacts would be inconsequential to birds and wetlands. Water and sediment quality construction impacts would generally be short term and limited to increased turbidity during retaining wall construction and filling. Recent studies indicate that water quality in this area of Middle Waterway is not too degraded (Isakson and Loehr 1981). Water quality impacts were thus rated as minimal.

Operation impacts would be moderate for fish and invertebrates and inconsequential to wetlands and birds. A long-term loss of a small area of productive benthic habitat (Blaylock and Houghton 1981) would lower overall waterway productivity but should be of only moderate significance. Water and sediment quality construction impacts would be inconsequential.

Human Environment: Construction activities would impose moderate land use impacts due to the generation of construction-related traffic along local road systems (including St. Paul Street, E. 11th Street, and others). Construction would impose no impacts on water use, since all construction activities are assumed to occur onshore. Even if barge-mounted construction equipment is used, such use would be minor and short term. Construction activities would impose moderate noise impacts on nearby uses, primarily due to filling activities.

Operation of project facilities would impose no impact on land and water use. The overall use of the site and area would not be altered. The expanded site area would provide additional space for onsite storage and operations. Some efficiencies of operations may be achieved, but it is assumed that this would not affect the size of the work force and would have little or no impact on product shipment. Project construction and operation would have minimal impact on aesthetic, recreational, and historic/cultural resources.

Project-Specific Mitigation

Specific mitigation has been designed to reduce the level of impact imposed on the natural environment by the Paxport Mill project (Stout 1983). This mitigation includes the creation of intertidal habitat to replace that destroyed or altered by construction of the concrete slab bulkhead. Mitigation entails the construction of an underwater revetment in the adjacent waterway about 80 feet from shore. The foot of the revetment, which runs parallel to the newly constructed bulkhead for

800 feet, is located at an elevation of -15 feet MLLW; the top of the revetment is at -6 feet MLLW. A long, narrow intertidal shelf is created by filling behind the revetment and creating a gradual slope upward toward the shore (approximately 15 percent) to an elevation of +6 feet MLLW. Surface water controls are also incorporated as part of the mitigative measures. The -6 to +6 feet MLLW elevation and fill material selected have been evaluated by the U.S. Fish and Wildlife Service (USFWS) as the optimum elevation and substrate for food organisms. The USFWS plans to monitor the effectiveness of this mitigation over the next several years.

Project-Specific Alternatives

The only alternative to the proposed fill that would allow expansion of Paxport's property would be to purchase adjacent property.

PROJECT NO. 26 PACIFIC YACHT BASIN REPAIR YARD

Sponsor: Pacific Yacht Basin Duration of Construction: <6 months
Development Subarea: 5

Activities: Upland marina construction, grading

Project Description

The applicant wishes to construct an onshore marina and repair facility at the southern end of Middle Waterway. All activities associated with the project would be onshore although some drainage of runoff from the site into the waterway could occur during construction or operation.

Impacts

Natural Environment: Construction impacts to study area biota and wetlands should be nonexistent based on the lack of in-water activities. A slight potential for runoff of contaminants into Middle Waterway during construction exists but overall water and sediment quality construction impacts would be inconsequential.

Operation impacts would also be inconsequential for fish, invertebrates, wetlands, and birds. Water and sediment quality operation impacts were rated minimal and limited to potential surface runoff of onsite contaminants into Middle Waterway.

Human Environment: Construction would generate a relatively small increase in the use of roads accessing the site (including E. F Street, E. 11th Street, and others) due to construction-associated traffic (movement of work force, materials, equipment). There would be no in-water construction activities; therefore, construction would impose no impact on water use. Construction would impose moderate noise impacts due to piledriving and grading activities. Minimal or no constraints would be imposed on aesthetic, recreation, and historical

Operation of the repair facility would be consistent with use in the area and plans and policies governing

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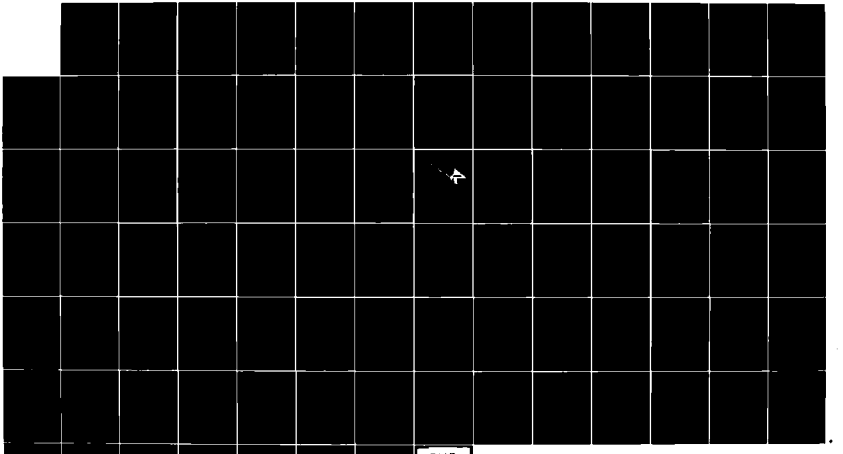

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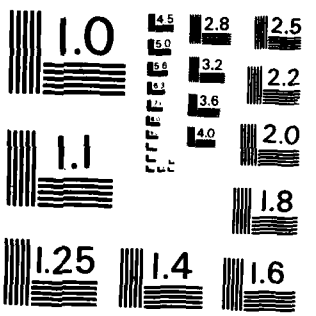


increase in land transportation systems would occur due to employee departures and arrivals and delivery of supplies and boats via truck. No waterborne delivery of boats is anticipated due to poor navigational conditions in the southern end of Middle Waterway; therefore, no impact on water use is anticipated. Operation of the completed facilities would impose minimum impacts on the noise environment, or aesthetics, recreational, and historic/cultural resources.

Project-Specific Mitigation

Control and cleanup of any spilled paints, solvents, or hydrocarbon products would eliminate the potential for toxicants entering the marine environment through surface or ground water pathways.

Project-Specific Alternatives

Consideration of alternatives does not appear warranted.

PROJECT NO. 27 FOSS TUG FLOAT

Sponsor: Foss Launch and Tug Co. Duration of Construction: <6 months
Development Subarea: 5 Corps Application No. 07-OYB-1-007178

Activities: Overwater construction, potential shore treatment, piledriving, pier construction

Project Description

Foss proposes to drive seven 7-pile dolphins in some -11 feet of water off their Middle Waterway property. These dolphins would support a 200- x 13-foot wooden float due south of their existing float. The float would be used to provide additional moorage for tugs and barges.

Impacts

Natural Environment: Construction impacts were rated inconsequential to fish, invertebrates, wetlands, and birds. Construction impacts on water and sediment quality would also be inconsequential and consist of short-term increases in turbidity and sedimentation during piledriving.

Operation impacts were rated minimal and inconsequential to study area biota, generally resulting from slightly increased operations levels. Water and sediment quality operation impacts are inconsequential.

Human Environment: Construction would impose moderate impacts on land use and inconsequential impacts on water use. During construction, adjacent portions of the Foss site would be temporarily used for staging of construction materials and equipment. Some increase of traffic along local roads (E. F Street, E. 11th Street) would occur, but would be minor in magnitude and extent. Adjacent waters would be used by construction vessels to drive about 50 piles and to position the float and access ramp. Due to the relatively light vessel traffic in Middle Waterway and positioning of construction vessels outside water use areas, these

activities would result in little interference with navigation. Construction activities would impose considerable noise impacts on the surrounding area due to piledriving, although construction noise would be temporary and intermittent. Construction would impose little or no impact on recreation, aesthetics, or historic/cultural resources.

Operation of the project would result in an increase (by a maximum of 75 percent) in moorage capacity at the Foss facilities. This would likely result in an increase in traffic using both land and water transportation systems. However, the project would not alter existing industrial land and water use at the site and in adjacent waters. Activities at the expanded facilities would generate an incremental increase in noise levels, but these impacts would be moderate in magnitude and extent and would not change the sound character of the area. Operation would have little or no effect on aesthetics, recreational, and historic/cultural resources.

Project-Specific Mitigation

No project-specific mitigation appears warranted. Generic measures for mitigating impacts associated with overwater construction, shore treatments, and piledriving.

Project-Specific Alternatives

Consideration of project-specific alternatives does not appear warranted.

PROJECT NO. 28 SUPERIOR OIL DOCK AND DREDGING

Sponsor: Superior Oil Company
Development Subarea: 6
Duration of Construction: <6 months
Corps Application No. 071-OYB-2-008549

Activities: Piledriving, dredging

Project Description

The applicant plans to dredge some 5,000 cubic yards of sediment from near the base of its existing pier on the east side of the entrance to City Waterway. Material would be removed by clamshell from a maximum of about 1 acre of bottom to maintain a working depth of -31 feet. Proposed disposal site is at Commencement Bay disposal site "B" off Browns Point. A new 21-pile dolphin would be added to improve mooring capabilities at the dock.

Impacts

Natural Environment: Construction impacts were rated inconsequential to birds and wetlands and moderate to fish and invertebrates. Approximately 1 acre of benthic habitat would be disrupted during the dredging operation. Potential water and sediment quality impacts during dredging would be considerable. Malins et al. (1980) found high concentrations of PCBs and certain heavy metals in sediments near the site. Sediment contaminants suspended during dredging could become available to resident biota or disperse to other areas of City Waterway adding to existing problems.

Operation impacts to fish and invertebrates were rated minimal and for wetlands and birds, inconsequential. Water and sediment quality impacts would probably be minimal during operation. Operation would result in more ship traffic and thus a potential for increased accidental spills.

Human Environment: Construction would impose moderate impacts on land and water use. Some minor traffic would be generated along access roads and onsite. Construction support vessel operations in the waterway (during transit) and in the adjacent berth area (during piledriving and dredging) may cause minor temporary interference with recreational boating. Construction noise impacts would be considerable. Piledriving would impose relatively high sound levels on noise-sensitive receptors in the Central Business District, although this impact would be intermittent and short term. Dredging activities would cause minimal impacts to aesthetics because of viewer expectation of customary activities within the industrial area.

Operation would impose moderate land and water use impacts. The project would not change the land and water use characteristics of the area. However, operation of the improved facilities may result in a minor increase in the number of vessel calls at the facility, resulting in a minor increase in vehicular traffic as well for the life of the project. Increased vessel operations around the completed dock facilities may incrementally increase the potential for vessel conflicts with recreational boats originating from the nearby Totem Boat Haven and other marinas. Project-generated noise may change the character of, but would not increase, ambient sound levels. Both construction and operation would have little or no impact on recreational or historic/cultural resources.

Project-Specific Mitigation

Use of a hydraulic rather than clamshell dredge would reduce water quality impacts during construction. Otherwise, no project-specific mitigation appears to be warranted.

Project-Specific Alternatives

Consideration of project-specific alternatives does not appear warranted.

PROJECT NO. 29 GLOBE MACHINE RAMP AND FLOAT

Sponsor: Globe Machine Co. Duration of Construction: <6 months
Development Subarea: 6

Activities: Overwater construction, shore treatment, piledriving, commercial pier construction

Project Description

The applicant proposes to construct a 335- by 10-foot concrete float with a ramp access south of their existing float on the east side of City Waterway. The float would be tethered between some 36 pilings and used for moorage and repair of vessels. The float would stand some 37 feet offshore over about -20 to -15 feet of water. Ramp width would be 10 feet.

Impacts

Natural Environment: Construction impacts to fish and invertebrates were rated minimal and to birds and wetlands, inconsequential. Piledriving would cause only a minor disturbance to resident biota. Water and sediment quality construction impacts were rated minimal based on high heavy metals concentration at sites near the project (Malins et al. 1980; Isakson and Loehr 1981) and the potential for suspension of sediment-bound contaminants during piledriving.

Operation impacts would be minimal to fish and invertebrates based on the possibility of increased accidental spills and the shading effect of the overwater structure. Operation impacts on wetlands and birds would be inconsequential. Water and sediment quality operation impacts would be minimal, primarily limited to an increased risk of accidental spills.

Human Environment: Construction would impose inconsequential impacts on land use. Some additional traffic would be generated along nearby roads (including E. D Street, E. 11th Street and others) during construction, but this impact would be short term and minor in magnitude and extent. Construction would generate water use impacts assessed as minimal, due to the relatively small scale of construction and the short time that construction support vessels would be present in City Waterway, although movement of construction vessels to and from the site would be via heavily used navigational channels in the waterway. Noise impacts would be generated during the driving of approximately 40 piles. Although this represents a relative low number of piles, construction noise impacts are assessed as considerable, due to the proximity of the construction site to sensitive uses in the Central Business District and in City Waterway proper (Tacoma Marina). Little or no construction impacts on recreational, aesthetic, and historic/cultural resources are expected.

Operation would impose minimal impacts on land use, moderate impacts on water use. The new facilities represent an extension of an existing machine shop use. Therefore, the expanded use is consistent with the industrial use of the site and existing uses in the area. Some increase in traffic along E. D Street may occur due to delivery of supplies to the boat repair facility, but this impact would be minor. The facility would attract a small number of additional vessels per day (average less than 3), but this increase would not tax the existing capacity of City Waterway. Boat repair activities would add incrementally to ambient sound levels, imposing moderate noise impacts to nearby properties and waters. The project would impose few, if any, impacts on the recreational, aesthetics, and historic/cultural resources in City Waterway and its approaches.

Project-Specific Mitigation

Proper handling, control, and cleanup of spills of potentially toxic materials would largely eliminate potential effects on water quality and marine biota. Other generic mitigation measures described in Chapter 5 for overwater structures, shore treatments, and piledriving apply.

Project-Specific Alternatives

Consideration of project-specific alternatives does not appear warranted.

PROJECT NO. 30 CITY MARINA EXPANSION

Sponsor: Marshall Perrow
Development Subarea: 6
Duration of Construction: <1 year
Corps Application No. 071-OYB-2-004322

Activities: Marina construction, potential shore treatment, piledriving, dredging, filling

Project Description

The applicant proposes to dredge, fill, and add floats to expand an existing marina by approximately 60 slips. The project site is located on the east side of City Waterway, just south of the 15th Street Bridge site. An area of some 0.5 acre from -6 to about +2 feet would be dredged (4,820 cubic yards) to -6 feet to accommodate boat slips. Material dredged, plus some additional upland fill, would be used to fill some 1.2 acres of tidelands between -7 feet and MHHW. Fill would be faced with broken concrete riprap. A marina office building would be constructed partially on piles over the riprapped slope and some 70 piles would be used to constrain the additional floating walkways comprising the boat slips. Existing parking would be expanded to accommodate 112 vehicles.

Impacts

Natural Environment: Construction impacts were rated inconsequential to birds and wetlands but moderate to fish and invertebrates. Construction would remove approximately 1.7 acres of intertidal/shallow subtidal habitat in an area of potentially high epibenthic invertebrate density and moderate fish use, though site-specific data are limited. Water and sediment quality construction impacts would be moderate as well. Based on limited data, high concentrations of heavy metals in the inner half of City Waterway (Isakson and Loehr 1981) and low survivorship in bioassay tests (Swartz et al. 1982) indicate relatively poor water and sediment quality in the project area. Sediment disruption during construction could cause short-term increases in contaminant levels.

Operation impacts were rated considerable to fish and invertebrates due to the long-term effects of habitat loss and a possible cumulative effect of water quality changes due to expanded marina operations throughout the waterway. Operation impacts on birds and wetlands would be inconsequential. Operation impacts on water and sediment quality were rated moderate since chronic minor spills of fuel, oil, human wastes, and garbage can be expected throughout the life of the project. Floating boat slips would further retard circulation and pollutant dispersal in the inner half of City Waterway.

Human Environment: Expansion of the City Marina would affect the human environment as described in the general discussion of marina impacts in Chapter 5. Construction would impose moderate land and water use impacts due to the increase in use of the local road system (E. D Street, E. 15th

Street, and others) and adjacent portions of City Waterway by construction-generated vehicular and vessel traffic. Construction-related traffic impacts would be short term and should not interfere with the movement of other vehicular and vessel traffic in the area. A portion of the site would be used to stage construction material and equipment. Use of the existing marina facilities also may be limited during construction, thereby temporarily reducing the number of recreational boating trips in the area. Noise impacts during construction would be considerable, primarily due to piledriving and dredging noise affecting the nearby Central Business District and other nearby marina uses (City Waterway Marina, Picks's Cove Marina). Construction would have minimal impacts on aesthetic and historic/cultural resources.

Operation of the expanded marina facilities would impose considerable impacts on land use. Over 1 acre of vacant land would be converted to marina use for the life of the project. Substantial automobile traffic would be generated (up to 250 trips in a peak day) along local access roads. Since only 112 parking spaces would be provided at the facility, overflow parking is likely to be accommodated along E. D Street. Operation would impose considerable impacts on water use. The waters immediately adjacent to the marina would receive increased use by recreational vessels (approximately 85 vessels would be generated in a peak summer day). The effects of this increased traffic would be mitigated as the vessels disperse into City Waterway and other marine waters of the area. The marina would impose moderate noise impacts in the area due primarily to boat and automobile engine noise. Although subject to viewer perception, the impact of converting open shoreline to marina use would impose moderate aesthetic impacts. Marina expansion would impose minimal impact on historic/cultural resources.

Project-Specific Mitigation

Access to the marina from E. D Street should be developed with sufficient curb cuts and turn lanes to accommodate the increase of turning movements into the expanded facilities. Sediment to be dredged should be tested to determine appropriate controls during dredging/filling. Generic mitigation measures regarding filling and shore treatments apply. Offsite mitigation for lost shallow water habitat may be warranted although -6 foot depth in the marina can be considered "shallow" (e.g., Project No. 21 Milwaukee Waterway fill).

Project-Specific Alternatives

Generic marina alternatives apply but may not be compatible with the goals and resources of the applicant.

PROJECT NO. 31 DILLINGHAM SITE MARINA EXPANSION

Sponsor: J.E. Meaker
Development Subarea: 6
Duration of Construction: <6 months
Corps Application No. 071-OYB-2-006384

Activities: Marina construction, piledriving, dredging, filling

Project Description

The applicant proposes dredging, filling, bulkheading, and dock and float construction to expand an existing marina on the east side of City Waterway by 45 moorages. A small area of bottom (<0.1 acre) would be dredged from +1 to -6 feet to a level -6 feet (<400 cubic yards). This material plus some upland fill would be placed behind a plank and piling bulkhead occupying less than 300 square feet of intertidal area. Bulkhead toe elevation would vary from MLLW to +9 feet. The concavity formed by the bulkhead would be decked over by a pile-supported wooden deck. Piles would also be placed in -6 to -18 feet of water to constrain the additional moorages.

Impacts

Natural Environment: Construction impacts were rated minimal to fish and invertebrates and inconsequential to wetlands and birds. The project site probably has limited use by juvenile salmonids and no data exist concerning benthic invertebrate density. Construction impacts on water and sediment quality would be moderate. Water quality is relatively poor in this area; high concentrations of heavy metals have been reported (Isakson and Loehr 1981) and bioassay results indicate potential sediment contamination (Swartz et al. 1982). Bottom disruption during construction could release sediment-bound contaminants into the water column and add to existing problems on a short-term basis.

Operation impacts were rated moderate to fish and invertebrates resulting from the effects of habitat loss and the possible cumulative effects of reduced water quality from increased marina operations in the waterway. Operation effects on wetlands would be minimal, on birds inconsequential. Water and sediment quality operation impacts would be moderate. Long-term inputs of fuel, oil, human wastes, and garbage during marina operation and the reduction of circulation and dispersion due to floating structures would cause a lowering of existing water quality in the area.

Human Environment: Construction impacts associated with marina expansion would be essentially the same as described for Project No. 30 and in the discussion of marina impacts in Chapter 5. Construction would impose moderate land use and water use impacts due to the relatively small scale of the expansion. Noise impacts would be considerable due to piledriving, dredging, and filling operations. Project construction would impose minimal or inconsequential impacts on recreation, aesthetics, and historic/cultural resources in City Waterway.

Operation of the expanded marina would impose moderate land use impacts, primarily due to the generation of vehicular traffic (up to 135 vehicles per peak summer day) along E. D Street and other access roads. Marina expansion represents a continuation of an existing use and is consistent with the character of the area. Water use impacts would be considerable. Although peak generated vessel traffic (45 per peak summer day) would be moderate, this peak level would be sustained for the life of the project. Noise impacts would be moderate, primarily due to engine noise. Although subject to viewer expectation marina expansion would have only moderate impacts on aesthetics. Operation would have little effect on recreation or historic/cultural resources in the area.

Project-Specific Mitigation

As for Project No. 30, access to the expanded marina facilities should be designed to reduce the potential for conflicts due to turning movements on E. D Street.

Project-Specific Alternatives

Generic marina alternatives apply but may not meet the goals of the applicant.

PROJECT NO. 32 PICK'S COVE COVERED MOORAGE

Sponsor: Pickering Industries, Inc.
Development Subarea: 6
Duration of Construction: <6 months
Corps Application No. 071-OYB-2-008255; recently cancelled

Activities: Minor marina-related construction of roofs over existing boat slips

Project Description

The applicant proposes to construct a roof over existing wet moorages at a marina on the east side of City Waterway. Roof would be 224 feet by 100 feet covering approximately 0.4 acre of water. Shaded water depth ranges from about -7.7 to -14.5 feet.

Impacts

Natural Environment: Impacts to study area biota, wetlands, water quality, and sediment quality should be inconsequential from construction and operation of this project.

Human Environment: Construction and operation of this project would have little or no impact on land and water use, recreational, aesthetic, and historic/cultural resources in City Waterway. During construction, noise impacts would be minimal. Operational noise would impose no impact on surrounding areas.

Project-Specific Mitigation

No project-specific mitigation appears warranted.

Project-Specific Alternatives

No project-specific alternatives were considered.

PROJECT NO. 33 DOCK STREET CONNECTOR

Sponsor: City of Tacoma
Development Subarea: 6
Duration of Construction: <1 year

Activities: Potential shore treatment, piledriving, potential filling, overwater construction, land construction

Project Description

To improve traffic flow to and from the Tacoma Central Business District, the city proposes to construct an arterial route around the south end of City Waterway. This arterial would be pile supported above a portion of intertidal mudflat at the head of the waterway. It was assumed that no more than 0.5 acre of upper intertidal area would be shaded by the project.

Impacts

Natural Environment: Construction impacts were rated inconsequential to birds and wetlands, and minimal to fish and invertebrates. A minor disturbance to benthic invertebrates and fish would occur during construction along with a small loss of habitat through piledriving. Construction impacts on water and sediment quality were rated minimal. Although water quality is relatively poor at the head of City Waterway (Isakson and Loehr 1981), construction activities should cause no measurable change.

Operation impacts were rated inconsequential to birds and wetlands and minimal to fish and invertebrates. A slight shading of intertidal habitat would occur which may slightly lower the production of benthic invertebrates seasonally supporting juvenile salmonids. Water and sediment quality operation impacts were rated minimal.

Human Environment: Connector construction would impose moderate impacts on land use. Construction would generate construction-related traffic along nearby roads (S. 23rd Street, S. 22nd Street, and E. D Street, among others). Vacant land near the construction site would be used to stage construction materials and equipment. Construction would have inconsequential to no impacts on water use. Assuming that required construction activities including piledriving would be performed from shore, only a few construction-related vessel trips would be generated, consisting primarily of vessels used to inspect pile and shore treatment construction. Noise impacts imposed by arterial construction would be severe due to noise generated by piledriving and machinery operation on nearby urban uses. Construction would impose moderate aesthetic impacts due primarily to temporary blockage of views of City Waterway from areas to the south of the waterway. Construction activities would impose little, if any, impact on recreational or historic/cultural resources.

Operation of the arterial would have moderate land use impact. Local traffic patterns would be altered with improved traffic movement around the end of City Waterway; a portion of the existing traffic using local roads would be diverted onto the new facilities. This redistribution may hasten conversion of lands to other more intensive uses in the future. A minor loss of access would be suffered by local business on S. 23rd Street and Dock Street. Some minor relocation of existing uses may be required. One-half acre of undeveloped land at the end of the waterway would be converted to transportation-related use for the life of the project. While none of these impacts are more than minor in magnitude, they would endure for the life of the project, resulting in a "moderate" rating under the criteria for assessment used in this study. In any case, the project is consistent with land use plans and policies for the area. The

project would have no impact on water use or historic/cultural resources of the area due to the project's location in an area severely altered by port development. Moderate impacts would occur to aesthetics due to the long-term duration of the project and the extent to which the project would be seen. Increased traffic in the area due to connector completion and operation would incrementally increase ambient sound levels near the project facilities; operation noise impacts are assessed as moderate.

Project-Specific Mitigation

No project-specific mitigation appears to be warranted. Generic mitigation measures discussed in Chapter 5 for shore treatment, piledriving, filling (as appropriate), and overwater construction apply.

Project-Specific Alternatives

Alternatives to the planned routing that avoid all marine impacts would be less favorable economically in that much more property acquisition and disruption of existing land uses would result.

PROJECT NO. 34 CITY WATERWAY MARINA EXPANSION

Sponsor: Morris & Sons, Inc. Duration of Construction: <6 months
Development Subarea: 6 Corps Application No. 071-OYB-1-007741

Activities: Marina construction, piledriving

Project Description

The applicant plans to drive pilings to constrain floats necessary to expand the existing marina by 34 slips. All work would be seaward of the existing facilities (approximately -15 to -17 feet) and it was assumed that there would be no change in existing shoreline configuration.

Impacts

Natural Environment: Construction impacts would be inconsequential to study area biota and wetlands. Water and sediment quality construction impacts were rated minimal. Piledriving would result in a short-term suspension of potentially contaminated sediments. This region of City Waterway has relatively poor water quality due to the presence of high concentrations of certain heavy metals (Isakson and Loehr 1981).

Operation impacts to fish and invertebrates were rated minimal, primarily an overall slight reduction in water quality from marina operation and the resulting effect on resident biota. Operation impacts on wetlands, birds, and sediment quality were rated inconsequential. Existing water quality is poor (Isakson and Loehr 1981) and slightly expanded marina operations from this project alone may add minimally to water quality degradation in City Waterway.

Human Environment: Construction and operation impacts associated with expansion of the City Waterway Marina would be similar to those described for other marina expansion projects (Nos. 29, 30) and in the discussion

of marina impacts in Chapter 5. Construction would impose minimal land use impacts; temporary and minor increases in traffic would be generated along Dock Street, E. 15th Stre t, Pacific Avenue, and other land routes of access. Impacts of project construction on water use would be moderate; adjacent waters would be used by construction vessels involved in piledriving, dredging, filling, and placement of overwater structures. However, such use would be short term and intermittent, resulting in relatively minor interference with marina-based recreational vessels. Piledriving, dredging, and filling would impose considerable noise impact on nearby receptors in the Central Business District and City Waterway, including several marinas. Construction would impose minimal to inconsequential impacts on recreational, aesthetic, and historic/cu tural resources in the area.

Operation would result in moderate land use impacts due to lo. :erm increases in local vehicular (up to 100 trips per peak summer d and vessel traffic (up to 35 trips per peak summer day). These incre = in use of land and water transportation systems would not substa .. ly reduce carrying capacities or levels of service, but they would end . for the life of the project. The project represents expansion of an existing marina use; therefore, the overall land and water use characteristics of the area would not change. Operation of the expanded marina facilities would impose moderate noise impacts on nearby uses; noise levels would not exceed standards, but would endure for the life of the project. Minimal to inconsequential adverse impacts would be imposed on aesthetic, recreational, and historic/cultural resources in the area.

Project-Specific Mitigation

No project-specific mitigation appears to be warranted. Generic mitigation measures for marina development and piledriving apply.

Project-Specific Alternatives

Generic marina alternatives apply but may not be compatible with the goals and resources of the applicant.

PROJECT NO. 35 UNION DEPOT REDEVELOPMENT

Sponsor: Glacier Park Corporation/ Cornerstone
Duration of Construction: 1+ years
Development Subarea: 6

Activities: Land construction, grading, paving, piledriving

Project Description

The applicants propose to develop the area from Union Depot north to the 15th Street Bridge, between S. 15th and S. 18th streets, for specialty retail shops, small businesses, and pedestrian walkways. Public access would be encouraged. It was assumed that construction would have no direct effects on the waterway.

Impacts

Natural Environment: Construction impacts were rated inconsequential to fish, invertebrates, and wetlands due to the lack of any in-water activities. Construction impacts on birds were rated minimal based on the loss of some passerine species' habitat during upland development. Water and sediment quality construction impacts were rated inconsequential.

Operation impacts were rated inconsequential to study area biota and wetlands with the exception of a minimal impact on some bird species due to the long-term effects of upland habitat loss. Water and sediment quality operation impacts were rated inconsequential.

Human Environment: Construction activities would impose considerable impacts on land use, assuming that construction of the three-block area is developed in one phase. The relatively large-scale redevelopment project would require longer than 1 year to complete. During this extended construction period, construction-related traffic would be generated along Jefferson Avenue, S. 18th Street, S. 15th Street, Pacific Avenue, and other local arterials. These are heavily traveled during peak hours and construction traffic during peak hours may substantially reduce surplus carrying capacities, reducing levels of service on downtown arterials and connectors. The project site would be used for the staging of construction materials and equipment. It is assumed that all construction activity would take place onshore; therefore, construction would have no direct effect on water use in City Waterway. Piledriving activity would impose severe noise impacts on surrounding land uses and sensitive uses near the Central Business District (possibly including St. Joseph's Hospital just over 1,500 feet from the depot structure). Construction activities may affect views toward the shore from City Waterway as well as obstruct views of the waterway from certain onshore locations. However, aesthetic impacts are rated as moderate, since they would be temporary and intermittent. Construction may or may not impose impacts on the existing depot structure; the exact design and extent of modification is unknown. It is assumed for the purpose of this analysis that any modifications to the existing depot would enhance its historic value. Construction would impose no other impacts on historic or cultural resources.

Operation of the Union Depot redevelopment would result in an intensification of existing land use onsite. The site is currently underutilized, consisting of the vacant depot structure and generally undeveloped surrounding parcels. Development of the site would result in considerable land use impacts stemming from conversion of the site to specialty retail and other business and commercial uses. Operation of the project facilities would generate substantial vehicle traffic along nearby access arterials and connecting roads, adding to heavy peak-hour traffic volumes in the area. Impacts on water use are judged to be minimal. The redeveloped depot site may attract minor recreational vessel traffic to City Waterway. Vessels would be required to use transient moorage of marinas on the west shore. The project, as preliminarily defined, is consistent with existing land and water use plans and policies. Operation of the project would impose minimal noise impacts and minimum adverse impacts on recreation and aesthetics. (The project in fact would have a net positive benefit on recreational and aesthetic resources in City Waterway.)

Completion of the project may hasten the redevelopment of nearby historic uses on Pacific Avenue and other nearby locations.

Project-Specific Mitigation

Special care should be taken in the designing of access to the Union Depot site. The incorporation of integrated turn lanes from existing road systems, signalization, and other roadway improvements have the potential for mitigating project-generated traffic impacts.

Project-Specific Alternatives

Other forms of development on this property (larger businesses, industrial uses, condominiums, etc.) would be less in keeping with the city's goal of providing increased public use and access to City Waterway. Creation of a park would be compatible with these goals but would require a substantial outlay of public funds to purchase the property and construct and maintain the facilities.

PROJECT NO. 36 TACOMA MARINA AND BREAKWATER

Sponsor: Tacoma Marina Association
Duration of Construction: <1 year
Development Subarea: 6
Corps Application No. 071-OYB-1-8438

Activities: Marina construction, breakwater construction, possible shore treatment, piledriving, potential filling, land construction

Project Description

The applicant proposes to construct a 278-slip marina comprised of a breakwater, pilings, floats (some covered), boat hoist, buildings, and walkways. A 270- x 16-foot concrete floating breakwater would be anchored near the mouth of City Waterway (west side) to reduce wave energy reaching the moorage area which would extend some 2,000 feet southward from the breakwater. The breakwater would be accessible via a ramp from shore and open to the public for fishing. Existing shoreline would be unchanged; however, all but one of the existing overwater buildings would be removed and existing decking would be upgraded or replaced to provide a pier/walkway over the water's edge. The southernmost existing warehouse would be retained and upgraded as a boat repair and sales building. Additional commercial buildings and parking areas (155 spaces) would occupy the remainder of the uplands of the site.

Wet moorage would be provided by a network of pile-constrained floats covering about 1 acre of water up to 34 feet deep.

Impacts

Natural Environment: Construction impacts for this project were judged to be generally inconsequential to wetlands and birds and minimal to fish and invertebrates. No major change in shoreline structure is planned and therefore installation of a floating breakwater and other floating structures should have little impact other than short-term disturbance of

resident fish and loss of a small area of benthic habitat from piledriving. Construction activities can be expected to disturb bottom sediments and cause a suspension of sediment-bound contaminants with a considerable potential impact on water and sediment quality. Malins et al. (1980) found elevated sediment concentrations of PCBs and certain heavy metals near the project area.

Operation impacts on fish and invertebrates were rated moderate. Operation should not affect seasonal juvenile salmonid passage along the shoreline but the cumulative effects of fuel spills and waste discharges from normal operation could degrade the health of resident biota and contribute to decreased productivity. Operation impacts on birds and wetlands were rated inconsequential. Water and sediment quality operational impacts were rated moderate. Water quality would be generally degraded over time due to the normal inputs associated with large marina operation. The presence of floating structures over a large area at the mouth of City Waterway would reduce circulation and flushing in the immediate vicinity and could potentially influence the entire waterway as well.

Human Environment: Marina construction would impose moderate land use impacts due to the generation of construction-related vehicle traffic along Dock Street, Pacific Avenue, and other local access roads during the 6- to 12-month construction period. During construction, portions of the site would be temporarily used to stage construction materials and equipment. Construction-related impacts on water use would also be moderate due to increased construction-related vessel traffic used in delivery of construction materials, piledriving, breakwater construction, positioning of floating marina facilities, and potential filling. Noise associated with project construction (piledriving, filling, etc.) would be severe. Construction impacts on aesthetics and recreational resources would be moderate. Public access to the project site would be restricted, but current public use of the site for recreation and viewing is relatively minor. Construction activities would change the appearance of the site from scenic viewpoints, but aesthetic impact would be moderate due to the intensity of human use of the City Waterway area. Construction would have minimal impacts on historic/cultural resources.

Operation of the marina facilities is consistent with existing land and water use plans and policies. However, the project would generate substantial vehicular traffic (over 800 trips on a peak summer day). Commercial uses to be developed on the upland portion of the site would generate additional vehicular traffic. While land and water use impacts associated with marina operation are assessed as considerable on the basis of these generated volumes, these represent peak volumes only. The facilities could be expected to generate around 300 vehicle trips and about 40 vessel trips on an average day. In any case, the surplus capacity of existing local roads and water approaches should be sufficient to carry even peak project-generated vehicle and vessel traffic volumes with some reduction in level of service. Project operation will not change the overall land and water use character of outer City Waterway, although development of vacant lands or redevelopment of existing uses may be hastened by project development. The complete marina would contribute moderate noise impacts on nearby uses (boat, vehicle engines), but would not impose excessive noise on sensitive receptors. Old, unused (in some

cases dilapidated) structures would be replaced by marina facilities. To most viewers, no perceived loss of aesthetic quality would occur from marina development; therefore, impacts on aesthetic resources would be moderate. Marine operations would not degrade existing recreational resources. Conversely, by development and operation these resources would be further enhanced by the opening of pedestrian walkways and the breakwater to the public for fishing. Removal of some existing buildings and refurbishing of the southernmost warehouse on the site potentially may have some historic impact.

Project-Specific Mitigation

The developers may be required to design and fund offsite roadway improvements along Dock Street to facilitate access to the site. Turning lanes at the site entrance may also be required along with signalization and other measures to minimize vehicle conflicts and improve levels of service during periods when marina-generated traffic volumes are highest (up to 140 vehicles per peak hour). The potential historic significance of the structures to be removed or rehabilitated should be determined prior to removal; improvements to be made to the remaining warehouse structure should enhance and protect its historic value.

Maximum application of generic mitgation alternatives applicable to marinas would greatly reduce the anticipated moderate risk to marine biota.

Project-Specific Alternatives

Generic marina alternatives apply but may not be compatible with the goals and resources of the applicant.

PROJECT NO. 37 NAVIGATION CHANNEL REALIGNMENT

Sponsor: City of Tacoma Duration of Construction: None
Development Subarea: 6

Activities: Regulatory

Project Description

The Corps plans to narrow the federal navigation channel in City Waterway by various amounts over the length of the waterway. The channel would be reduced from its present 580-foot width to 390 feet from its mouth to the southern end of the Totem Boat Haven (a distance of approximately 0.6 mile). Existing channel width would be retained south for a distance of about 0.3 mile to a point just past the 15th Street Bridge site, where it would narrow to 230 feet for a distance of approximately 0.4 mile to Pick's Cove Marina. At Pick's Cove Marina, the channel would narrow to 100 feet to the entrance of the turning basin. The width of the turning basin would be reduced by 100 feet on either side, resulting in a turning basin width of approximately 500 feet. This action would allow additional overwater development and reduce the need for maintenance dredging of the channel.

The Corps report assessing the feasibility of channel realignment states that this project is a regulatory function only, and consideration of any project that may be developed as an indirect result of channel realignment is subject to individual assessment under appropriate permit review processes. For the purposes of this assessment, indirect impacts would be only briefly discussed as they may affect elements of the natural and human environment.

Impacts

Natural Environment: No construction or operation impacts are involved and thus there would be no effects on study area biota, wetlands, water quality, and sediment quality.

Operation of new channel boundaries in City Waterway may have a moderate indirect effect on water quality. At least two of the marina developments proposed for City Waterway (Project Nos. 34 and 36) depend on channel realignment so that floating boat slips can be extended farther out into the waterway. This would decrease circulation and flushing of the waterway, thereby increasing pollutant residence time.

Human Environment: This project would impose no direct impacts on land and water use, noise, aesthetics, recreation, or historic/cultural resources. Indirect impacts associated with the potential for future marina development and construction of other overwater structures extending to the new channel boundaries would include restriction of the channel area available for navigation with some loss of carrying capacity. Channel realignment may have indirect land use impacts, since the development potential of water-oriented commercial uses such as marinas would be enhanced.

Project-Specific Mitigation

No project-specific mitigation appears to be warranted.

Project-Specific Alternatives

A variety of channel realignment configurations are possible. However, the proposed realignment has been selected to optimize the future of City Waterway as a "people-oriented" water body.

7. FULL SUBAREA DEVELOPMENT

This chapter presents a synopsis of the likely cumulative effect on the natural and human environments assuming construction and completion of all of the individual projects discussed under each subarea in Chapter 6.

SUBAREA 1: HYLEBOS WATERWAY

Natural Environment

Assuming that all projects proposed for Subarea 1 are in place, approximately 4.4 acres of bottom habitat will have been disrupted and its bathymetry altered by dredging (dredging volume of 31,000 cubic yards (Table 2). Known sediment quality in areas to be dredged is poor; thus redistribution of sediment-bound toxicants to other areas of Hylebos Waterway could occur, further degrading sediment quality in Subarea 1. Fill activities will cover approximately 25.7 acres of bottom from depths of -9.0 feet to mean higher high water (MHHW--about 11.8 feet) (Table 2). The net loss of existing shoreline will be approximately 975 feet at MHHW or about 2.8 percent of the total.

Cumulative effects on local biota will likely be seen as an overall decrease in biological productivity. The majority of the bottom area lost is intertidal or shallow subtidal (e.g., <-10 feet) habitat supporting algal primary production which, along with organic detrital inputs, supports benthic and epibenthic invertebrates. Juvenile salmonid rearing and demersal marine fish foraging as well as bird feeding in these nearshore shallow water areas would be reduced as benthic production is lost due to habitat removal. Shallow water habitat lost within the waterway itself constitutes some 35 percent of available similar habitat between mean lower low water (MLLW) and MHHW. This loss may be of significance to efforts to enhance salmonid production and survival in streams entering Commencement Bay and especially in Hylebos Creek.

Overwater structures, both floating and fixed, will cover approximately 1 acre of surface water (Table 2), thereby slightly decreasing primary productivity through shading. These structures, as well as pilings, will attract and promote the establishment of a new community composed of attached algae and invertebrates and fish species associated with in-water structures, thereby partially offsetting the loss of productivity imposed by these structures.

Shore treatment in Subarea 1 will result in rock riprap and vertical pile and planking replacing about 2/3 mile of existing shoreline or about 10 percent of the total. However, much of the existing Hylebos Waterway shoreline is developed or "protected" in some form or another and little natural shoreline exists apart from areas of intertidal mudflats. The shoreline treatment will occur at the mouth, middle, and head of Hylebos Waterway which will result in a lower overall impact than if it occurred in a continuous segment. Shore treatment will probably have a slight effect on juvenile salmonid movement through replacement of sloping shoreline with more vertical faces, possibly retarding school passage and increasing exposure to predators. Riprap shore treatment will have less impact than vertical pile.

TABLE 2

PHYSICAL CHARACTERISTICS OF PROJECTS IN SUBAREA 1 - HYLEBOS[a]

Project Name	Dredging			Filling											
				Fill					Overwater Structures			Shore Treatment			
	Sediment Quality[b]	Volume (1,000 yds^3)	Bottom Area (acres)	Source	Quality[b]	Bottom Area Acres	Depths (feet)	Net Shoreline Loss (feet)	Floating (acres)	Fixed (acres)	Pile-driving	Type	Length (feet)	Wetland Loss (acres)	Marina Slips Added
1. Hylebos Marina	Probably poor	30	4.3	Adjacent dredging	Probably poor	2.6	-9 to +11.8	375	0.25-0.5	--	Yes	Vertical piles and rock facing	1,100	3.0	308
2. Sound Refining Pier Expansion	--	--	--	Upland?	Good	22	-2 to MHHW	600 @ MHHW	--	Probable <0.1	Probable	Unknown	1,800	3.9 salt marsh	--
3. Johnson Dock	--	--	--	--	--	--	--	--	<0.001	--	Limited	--	--	--	--
4. Marine Technical Services Pier and Warehouses	Probably poor	<1	<1	Upland	Good	0.1	-9.4 to MHHW	--	<0.001	0.46	Yes	Vertical piles	600	--	--
5. Louisiana-Pacific Log Handling Facility	--	--	--	Upland	Good	<0.01	0 to MHHW	--	--	<0.001	Yes	Rock riprap	16	--	--
6. Hooker Chemical Modernization	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Subarea 1 Totals	Generally poor	31	4.4	--	--	25.7	-9 to MHHW	975	0.25-0.5	0.47	Yes	--	3,516	6.9	308

(a) This table reflects the physical characteristics of the property identified for assessment under the COBS II study effort only. This table, therefore, represents a static assessment of projects identified through January 1, 1983, and is not intended to present the total losses of habitat that will occur as additional projects are proposed and developed in the study area. Some of the numerical values are estimates based on best-available data and conceptual plans.

(b) Quality is based on the known or suspected presence of toxic materials. Higher amounts of toxic materials decrease quality.

MHHW = mean higher high water

MLLW = mean lower low water

Filling 3.9 acres of salt marsh (Table 2) represents a loss of 72 percent of the remaining 5.4 acres of salt marsh in Commencement Bay, all of which is located in Subarea 1. This wetland type has the highest overall productivity level of wetland types found within Commencement Bay (Boule and Dybdahl 1981). Because of its tidal character, this wetland type is particularly important in detrital export to adjacent marine waters. Lowered biological productivity will result from wetland elimination.

The addition of 308 marina slips (Table 2) at one location will likely impact the immediately adjacent waters with increased inputs of fuel, oil, and sewage. However, dilution and the proposed marina's location near the mouth of the waterway will likely prevent these inputs from greatly affecting the overall water quality of Subarea 1.

Apart from the removal of bottom habitat through dredging and filling during the construction period, the construction and operation activities proposed for Subarea 1 will probably not produce any immediate, visible effects in the local biota. However, disturbances that affect productivity levels or community structure produce changes that often do not become evident for considerable periods of time. Therefore, it is difficult to reliably equate probable changes in the biological system with a specific disturbance, especially if that disturbance only produces long-term sublethal effects. By far the most significant impacts in this subarea will result from direct loss of mudflat, sandflat, and salt marsh habitats.

Human Environment

All projects planned or envisioned for Subarea 1 are consistent with the general provisions of existing land and water use plans and policies that direct growth and development in the subarea; that is, all projects represent mixed public and private shoreline uses permitted in Shoreline District S-11 and S-12 (Hylebos Marina) and industrial uses permitted in Shoreline District S-10 (all other projects; see Chapter 8). Only two of the projects (Project No. 1: Hylebos Marina, and Project No. 2: Sound Refining Pier Expansion) are not fully consistent with elements of the existing land use plans and policies. These plans and policies provide for a multiplicity of urban uses along urban shorelines, but also provide for preservation of shorelines with natural amenities and wetlands (see the appropriate project descriptions and environmental assessments [Chapter 6] and discussion of effective land use plans and policies in Johnston [1981, pp. 74-128]). These two projects, as indicated above, will result in the elimination of many of the natural onshore amenities remaining in the subarea, with associated adverse impacts on recreational and aesthetic resources.

The existing general land use of the subarea will remain intact even if all identified projects are developed. Incremental increases in vehicular traffic will be generated by construction and operation of all projects in the subarea (with the exception of Project No. 6: Hooker Chemical Modernization). Most of the projects will generate additional vessel traffic. In the case of the proposed Hylebos Marina, generated vehicle and vessel traffic volumes will be substantial and may

create a navigational hazard at the entrance to the waterway. For the most part, the surplus carrying capacities of the arterial and connector road systems serving the subarea and the marine waters of Hylebos Waterway and the Commencement Bay approaches are sufficient to accommodate project-generated increases in use. However, vehicle and vessel traffic generated by the proposed Hylebos Marina during peak hours (summer weekend) may substantially reduce levels of service on Marine View Drive.

Development of all identified projects in Subarea 1 will create temporary construction noise impacts during individual project development. The two largest projects (Hylebos Marina and Sound Refining) are located nearly 1 mile apart. Therefore, even simultaneous piledriving activities will have little cumulative impact. Noise generated by full operation of all projects will not change ambient sound levels appreciably; combined operational noise will be consistent with the existing sound environment.

Development of all identified projects will have little recreational impact on the landward end of Hylebos Waterway. However, construction and operation of the Hylebos Marina and the Sound Refining facility near the mouth of the waterway will degrade or eliminate areas that currently are used to a minor extent for recreation (birdwatching and/or beachcombing).

Development of all projects in Hylebos Waterway (Project Nos. 2 through 6) will have little or no effect on the aesthetic character of the area. Construction and operation of the Hylebos Marina will alter the visual character of the existing natural shoreline as described under the assessment of project-specific impacts.

Little or no impact on historic/cultural resources will be imposed by development of projects in Hylebos Waterway. Some additional degradation of water areas and shorelines traditionally used by the Puyallup Nation will occur; however, this impact will be minimal due to the extent to which such resources have already been modified. The Hylebos Marina will substantially alter relatively natural shoreline at the proposed site, resulting in a potential for destruction of cultural resources at that location.

SUBAREA 2: BLAIR AND SITCUM WATERWAYS

Natural Environment

Approximately 2.7 million cubic yards of sediment covering some 256 acres of bottom (Table 3) will be dredged from Subarea 2 if all proposed projects are completed. This represents essentially all of the deeper bottom area within the existing federal navigation channel as well as approximately 5.6 acres outside this channel. Sediment quality is generally poor in deeper water but better nearshore; the extensive dredging planned will probably create a short-term decrease in water quality as sediment-bound toxicants are resuspended and dispersed throughout the subarea by tidal circulation. The potential also exists for adjacent waterway areas to receive these suspended sediments resulting in water and sediment quality degradation. However, once dredging is

TABLE 3

PHYSICAL CHARACTERISTICS OF PROJECTS IN SUBAREA 2 - BLAIR[a]

Project Name	Dredging			Filling					Overwater Structures			Shore Treatment		Wetland Loss	Marina Slips Added
	Sediment Quality[b]	Volume (1,000 yds^3)	Bottom Area (acres)	Fill Source	Fill Quality[b]	Bottom Area Acres	Depths (feet)	Net Shoreline Loss (feet)	Floating (acres)	Fixed (acres)	Pile-driving	Type	Length (feet)	(acres)	
7. Blair Waterway Dredging and Bridge Replacement	Variable to poor	2,375	250	--	--	--	--	--	--	--	--	--	--	(possible at disposal sites)	--
8. TOTE Relocation and Finger Piers	Probably OK	270	6.5 (2.9 in uplands)	--	--	(2.9 net gain)	(40)	(150 gain)	--	0.2	Yes	Riprap	1,100	--	--
9. Pierce County Terminal Berth	Probably poor	?	1	--	--	--	--	--	--	2.5	Yes	Probable riprap	900	(possible in wetland area)	--
10. Pierce County Terminal Berth A and B Extension	--	--	--	--	--	--	--	--	--	0.3	Yes	Probable riprap	300	--	--
11. Fife Storm Drain and Outfall	--	--	--	Upland	Clean	0.3	-12 to MHHW	40	--	--	No	Riprap	155	--	--
12. Concrete Technology Dredging	Probably OK	25	0.35	--	--	--	--	--	--	--	No	--	--	--	--
13. Port of Tacoma Terminal 4 Expansion and Dredging	Probably OK	50	1	--	--	--	--	--	--	0.94	Yes	Riprap	300	--	--
14. Port of Tacoma Slip 2 Fill	--	--	--	Upland[c]	Clean	4	-16 to MHHW	500	--	--	Yes	Riprap	750	--	Possible
15. Port of Tacoma Piers 1 and 2 Retirement, and Slip 1 Fill	--	--	--	Upland[c]	Clean	16	-30 to MHHW	3,500	--	Possible	Possible	Probable riprap	2,000	--	--
16. Port of Tacoma Pier 5 Fill	--	--	--	Upland[c]	Clean	0.7	-30 to MHHW	1,200	--	Possible	Possible	Probable riprap	75	--	--
Subarea 2 Totals	Variable to poor	-- 3,720+	256	Upland[c]	Clean	40.1	-30 to MHHW	5,090 net loss	None	3.94+	Yes	--	5,480	Possible	Possible

(a) Please see footnote (a) under Table 2.
(b) Quality is based on the known or suspected presence of toxic materials. Higher amounts of toxic materials decrease quality.
(c) Assumed use of clean upland fill. If Blair Waterway sediments were used, fill quality would be variable to poor.
MHHW = mean higher high water
MLLW = mean lower low water

completed the overall "health" of Blair Waterway sediments should be greatly improved assuming that dredging exposes clean, unpolluted sediments.

Benthic productivity in Blair Waterway will be low until recolonization is complete. However, assuming a change from polluted to clean sediments, a more abundant fauna may become established and result in a higher level of productivity than currently exists.

A net loss of 18.1 acres of benthic habitat between -30.0 feet and MHHW will occur through filling if full subarea development proceeds. This habitat is primarily steep-sloped, riprapped shoreline with the exception of the relatively shallow areas involved in proposed Project No. 14 (Table 3). This area and that affected by Project No. 13 represent the only nearshore, shallow-water mud bottom areas in Blair Waterway that do not slope steeply to the channel bottom. Net shoreline loss through filling will be approximately 5,090 feet or about 12 percent of the existing shoreline.

Fixed overwater structures will cover at least 3.9 acres of water surface, shading surface layers and slightly reducing primary productivity. However, approximately 250 acres of surface water exist in Blair Waterway so removal of 3.9 acres represents a loss of only 1.6 percent of the total. The biotic community attracted to and colonizing piles for these structures will also partially offset the loss of primary productivity through shading.

Shore treatment, primarily by riprap with much of it under piers, will occur along approximately 5,480 feet of shoreline. This should not present a substantial impact, however, since the majority of the Blair Waterway shoreline currently is riprapped. Riprap is also preferable to vertical piling or bulkheading from the standpoint of juvenile salmonid movement.

Loss of freshwater wetlands through dredge disposal is possible although specific disposal sites for projects within this subarea have not been identified. Given the small acreage of freshwater wetlands remaining within the Commencement Bay area, loss of any portion through dredge disposal would carry a substantial cumulative impact.

Human Environment

The 10 projects identified for development in Blair Waterway are permitted uses under effective land and water use plans and policies. Development of all projects will be consistent with the planned industrial use of the area and is consistent with uses permitted in Shoreline District S-10 (see Chapter 8) and the general goals and policies in other land and water use plans effective in the area.

Projects planned for Blair Waterway will increase use of land and water transportation systems. Individually, the projects will not tax the surplus carrying capacity of local arterials or Blair Waterway and its Commencement Bay approaches. Development of large-scale marine terminals in outer Blair Waterway and in the inner turning basin will

generate substantial vehicle traffic (including trucks required to transport goods) along local arterials connecting the port industrial area with Interstate-5, State Route 99, and other regional highways. Use of local rail transportation systems will also increase. The use of Blair Waterway by large vessels will increase, although development of all identified projects will not likely increase vessel traffic by more than two such vessels per day, creating only a moderate effect on navigational safety in the waterway. The navigational hazard imposed by the E. 11th Street Bridge will be removed under the Blair Waterway dredging project (No. 7). Improved navigation will facilitate vessel transits to the new or expanded Pierce County facilities. A potential conflict may exist between Project No. 10 (Pierce County Terminal Berths A and B Extension) and Project No. 11 (Fife Storm Drain and Outfall) (see the individual project descriptions). Mitigation of the associated navigational hazard (fill interferences with the adjacent berth) will be required prior to codevelopment of the two projects.

Cumulative noise impacts may occur if two or more projects requiring piledriving, filling, dredging, and other construction activities that generate relatively high temporary noise impacts are developed concurrently in proximity to one another. While these impacts will be temporary and intermittent, concurrent project development may intensify construction noise impact. Conversely, concurrent development may reduce the length of time other uses are subjected to construction noise impacts.

Construction and operation of Blair Waterway projects will have little or no cumulative impact on aesthetic resources in the waterway. Blair Waterway is not generally used for recreation by the public, and there are no known historic or cultural resources in the waterway area.

SUBAREA 3: SITCUM/MILWAUKEE WATERWAYS

Natural Environment

A total of 189,000 cubic yards of sediment (Table 4) will be dredged from Subarea 3 under a full development scenario, affecting a bottom area of 49 acres. All dredging will be within Sitcum Waterway at depths below -25 feet. While present studies have indicated that at least some areas of sediment in the subarea are contaminated, the total extent of contamination is not known. Short-term water quality problems may result as sediment-bound toxicants are resuspended and settle during the dredging process. Fill activities constitute a major portion of the proposed development in this subarea; 44.5 acres of intertidal and subtidal habitat will be filled, the majority (40 acres) in Milwaukee Waterway with two smaller areas (2.0 and 2.5 acres) in Sitcum Waterway (Table 4). Fill would thus remove approximately 47.5 percent of the intertidal and subtidal habitat within this subarea and result in a net shoreline loss of approximately 6,500 feet (48 percent of the total).

Cumulative effects from dredge and fill operations on resident and migratory biota will likely be considerable. Benthic production within Sitcum Waterway will be substantially reduced after dredging and may not return to predredge levels for an extended time period (i.e., a year or

TABLE 4

PHYSICAL CHARACTERISTICS OF PROJECTS IN SUBAREA 3 - SITCUM/MILWAUKEE[a]

Project Name	Dredging			Filling					Overwater Structures			Shore Treatment			
	Sediment Quality[b]	Volume (1,000 yds^3)	Bottom Area (acres)	Fill Source	Fill Quality[b]	Bottom Area Acres	Bottom Area Depths (feet)	Net Shoreline Loss (feet)	Floating (acres)	Fixed (acres)	Pile-driving	Type	Length (feet)	Wetland Loss (acres)	Marina Slips Added
17. Port of Tacoma Berth D Terminal 7 Extension	--	--	--	Unknown	Assume clean	2.5	? to MHHW	100	--	1	Yes	Bulkhead upper, riprap under pier	900	--	--
18. Sitcum Waterway Shoal Dredging	Probably marginal	41	3	--	--	--	--	--	--	--	--	--	--	--	--
19. Sitcum Waterway Dredging	Variable to poor	148	46	--	--	--	--	--	--	--	--	--	--	(possible at disposal sites)	--
20. Port of Tacoma Wharf	--	--	--	Unknown	Assume clean	2.0	? to MHHW	100	--	3.7	Yes	Bulkhead upper, riprap under pier	1,600	--	--
21. Milwaukee Waterway Fill	--	--	--	Blair/ Sitcum	Variable; some poor	40	-33 to MHHW	6,300	--	--	--	Riprap	2,250	(Intertidal only)	--
22. Milwaukee Waterway Railroad Yard Paving	--	--	--	--	--	--	--	--	--	--	--	Riprap	40[c]	--	--
23. Port of Tacoma Parcel 5 Fill	--	--	--	Unknown	Assume clean	--	--	--	--	--	--	--	--	9.6	--
Subarea 3 Totals	Variable to poor	189	49	--	Variable; some poor	44.5	-33 to MHHW	6,500	--	4.7	Yes	--	4,750	9.6+	--

a) Please see footnote (a) under Table 2.
(b) Quality is based on the known or suspected presence of toxic materials. Higher amounts of toxic materials decrease quality.
(c) Not figured in subarea totals because would be covered by Project 21.
MHHW - mean higher high water
MLLW - mean lower low water

more) depending on recolonization rates. Benthic production within Milwaukee Waterway will be entirely eliminated. Pelagic species, including marine fish and anadromous salmonids, will experience a short-term construction-related disturbance of their activities in Sitcum Waterway but should resume normal activities soon after dredging is completed.

Fish use of Milwaukee Waterway will be eliminated. The potential long-term impacts upon outmigrating juvenile salmonids will be considerable since the intertidal flats at the mouth of the waterway and to a lesser degree the waterway itself, are used extensively during the early outmigration period of pink, chum, and chinook salmon (Dames & Moore 1982). No comparable, shallow water nearshore habitat adjacent to the mouth of the Puyallup River is available. Juvenile salmonids leaving the Puyallup River will encounter relatively deep water and steep shoreline slopes to the northeast of the river mouth under a full development scenario for Subarea 3. This could result in slower school movement, increased exposure to predators, and most importantly, a loss of feeding habitat adjacent to the river mouth. Mitigation measures under consideration in the EIS process may greatly reduce the significance of these impacts.

Overwater structures (primarily fixed wharves) and piles will produce shading effects over approximately 4.7 acres of water surface and remove some open water habitat (approximately 10 percent of the total). This loss should be partially offset by the biotic community attracted to and colonizing these structures.

Shore treatment, consisting of both vertical bulkheads and riprap, will be applied along 4,750 feet of shoreline (Table 4). Approximately half of this would be around the perimeter of the Milwaukee Waterway fill boundary creating a new shoreline habitat and contributing to the impacts on biota discussed above concerning dredge and fill operations. The remainder, approximately 2,500 feet, is planned for 2 areas of Sitcum Waterway and represents a modification of about 34 percent of the existing shoreline, most of which is currently modified from a natural state.

Both intertidal and freshwater wetlands will be lost through full development of Subarea 3. The major intertidal areas lie within Milwaukee Waterway and at its mouth; the effects of their removal have been discussed above. Approximately 9.6 acres of wetland identified as freshwater tidal marsh by Boule and Dybdahl (1981) will be eliminated (Project No. 23). This is the only occurrence of this wetland type within the Commencement Bay area. Recent illegal filling activities have reduced the areal extent of this wetlant habitat to considerably less than 9.6 acres. The loss of a portion of this wetland constitutes a serious impact which could be mitigated through in-kind replacement.

Human Environment

The net effect of developing all seven projects planned or envisioned in the Sitcum/Milwaukee waterways subarea will be to intensify activities associated with large marine terminals such as those currently located within the subarea. The marine terminal currently used by TOTE on the west shore of Sitcum will be upgraded and expanded to support a new

containerized cargo terminal facility. Existing terminal facilities on the east shore of Sitcum also will be upgraded. Therefore, the overall land and water use character of the Sitcum Waterway portion of the subarea will not change.

Milwaukee Waterway and Parcel 5 will be filled and developed to support the new containerized cargo terminal, resulting in an intensification of use of currently vacant lands surrounding Milwaukee Waterway.

Planned development in the Sitcum/Milwaukee waterways subarea is fully consistent with land and water use plans for the greater Port of Tacoma area. Concentration of industrial areas is encouraged in the plans, and development of major terminal uses conforms with the industrial uses permitted in Shoreline District S-10, in which Sitcum and Milwaukee waterways are located (see Chapter 8).

Intensified cargo terminal uses in the subarea will generate increases in truck, automobile, rail, and vessel traffic along existing transportation systems. Vehicular traffic increases will reduce the surplus carrying capacity of E. 11th Street, Milwaukee Way, Port of Tacoma Road, and other major connectors to I-5 and State Route 99; however, with the development of good access from the site to these connectors, increased traffic volumes should be accommodated without significant losses in levels of service. Effects of project-generated traffic increases on the region will be minimal due to dispersion.

Cumulative noise impacts associated with planned subarea development are the same as described for Subarea 2. Development of all subarea projects will impose minimal or inconsequential impact on recreational, aesthetic, and historic/cultural resources in the subarea.

SUBAREA 4: PORT INDUSTRIAL FLATS

Natural Environment

No projects are currently planned for Subarea 4. However, assuming future full development consistent with current land use plans and policies will occur, cumulative impacts on the natural environment can be predicted.

Subarea 4 contains the majority of the remaining freshwater wetlands in the Commencement Bay area. Six different wetland types, primarily freshwater marsh and seasonal pond habitats, cover approximately 52 acres in Subarea 4 (Boule and Dybdahl 1981). This represents about 93 percent of the total freshwater wetland acreage in Commencement Bay upland areas, excluding wetlands affected by Projects No. 1 (Hylebos Marina), No. 2 (Sound Refining Pier Expansion), and No. 23 (Port of Tacoma Parcel 5 Fill). Wetland removal will affect bird and small mammal habitat and eliminate areas important in enhancement of surface water quality and storage of runoff.

Human Environment

Future uses likely to be developed in this area will be land-transportation dependent and as such will generate an increase in the use of local arterials connecting to I-5 and State Route 99 to the south and local rail systems. Any such uses will be consistent with effective land use plans and policies, which provide for the concentration of industrial and commercial uses in areas designated for such use (e.g., the port industrial area) and the development of traffic-intensive uses in areas with good access to regional transportation systems. Traffic increases will impose incremental increases in noise levels due primarily to nearby truck traffic; magnitude and extent of this impact will depend upon the type and location of projects developed.

Development in Subarea 4 will not likely impose substantial, unmitigatable impacts on the limited recreational, aesthetic, and historic/cultural resources in the subarea.

SUBAREA 5: ST. PAUL/MIDDLE WATERWAYS

Natural Environment

Dredging within the Puyallup River for training wall maintenance (Project No. 24) is the only dredge activity proposed within Subarea 5. Since the dredge quantities and extent are unknown, cumulative impacts are difficult to predict. They are expected to be slight because of the natural dynamic nature of the river bed in this reach.

Approximately 0.6 acre of intertidal substrate (between -15 and 6.0 feet relative to MLLW) will be lost due to filling in Subarea 5 (Table 5). Exclusive of the Puyallup River delta intertidal area, this represents less than one-half of 1 percent of the approximate 25.6 acres of intertidal substrate in this subarea. The cumulative impacts of fill activities in this subarea will therefore be minimal.

Floating and fixed overwater structures will cover less than 0.1 acre and approximately 0.5 acre of surface water, respectively (Table 5). This is a very small percentage of the area of surface water in Subarea 5, and effects on primary productivity through shading should be negligible. A minimal amount of piledriving will accompany these projects.

Shore treatment proposed in Subarea 5 may have the cumulative effect of slightly lowering habitat value for birds, especially along the Puyallup River. If riparian vegetation is removed along existing levee banks and replaced by vertical bulkheads, there would be a net loss in nesting, feeding, or roosting habitat for certain bird species. The loss will probably be small and not measurable over a long period.

It should be noted that the City of Tacoma Sewage Treatment Plant No. 1 (which currently discharges to the lower Puyallup River) is undergoing evaluations as part of the 301(h) waiver process. The initial 301(h) waiver was rejected by EPA. Currently, the City of Tacoma is completing water quality and ocean current studies in support of preparation of a second 301(h) waiver application. Depending on final outcome of EPA

TABLE 5

PHYSICAL CHARACTERISTICS OF PROJECTS IN SUBAREA 5 - PUYALLUP, ST. PAUL, MIDDLE[a]

	Dredging			Filling											
						Bottom Area		Net Shoreline	Overwater Structures			Shore Treatment		Wetland	Marina
Project Name	Sediment Quality[b]	Volume (1,000 yds^3)	Bottom Area (acres)	Fill Source	Fill Quality[b]	Acres	Depths (feet)	Loss (feet)	Floating (acres)	Fixed (acres)	Pile-driving	Type	Length (feet)	Loss (acres)	Slips Added
24. Puyallup River Training Wall Maintenance	Variable to poor	Unknown	Unknown	(unlikely)	--	--	--	--	--	--	Yes	Vertical plank bulk-heads; rock riprap	Unknown but large (several miles?)	--	--
25. Paxport Mills Bulkhead	--	--	--	Upland and concrete rubble	Good	0.6	-1.5 to +6	--	--	--	--	Vertical concrete wall with rubble slope below +9.4 feet	640	--	--
26. Pacific Yacht Basin Repair Yard	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
27. Foss Tug Float	--	--	--	--	--	--	--	--	<0.01	0.05	Yes	--	--	--	--
Subarea 4 Totals	--	--	--	--	Good	0.6	-1.5 to +6	--	<0.01	0.05	Yes	--	640 (marine) plus Puyallup River	--	--

(a) Please see footnote (a) under Table 2.
(b) Quality is based on the known or suspected presence of toxic materials. Higher amounts of toxic materials decrease quality.
MHHW = mean higher high water
MLLW = mean lower low water

evaluations, the City of Tacoma may be required to implement measures designed to improve both water and sediment quality near the lower Puyallup River, its delta, and Commencement Bay.

Human Environment

The relatively small-scale projects planned for development in this subarea (Project Nos. 24 through 27) will impose minimal impacts on the human environment. All four projects are consistent with existing land and water use plans and policies.

Project No. 24 (Puyallup River Training Wall Maintenance) is located in both Shoreline District S-9 (which has an associated general plan concept of mixed public use) and S-10 (industrial use) (see Chapter 8). Wall maintenance will be permitted in both districts. The remaining three projects represent small commercial developments located in Shoreline District S-10 (industrial use). All three planned projects are consistent with uses permitted in the shoreline district. Development of all projects will not change the existing land and water use characteristics of the area.

Relatively small increases in vehicular and vessel traffic will be generated by development of all four projects. Sufficient surplus capacity exists to accommodate all planned projects. Operation of all four projects will have little or no effect on recreational, aesthetic, and historic/cultural resources.

SUBAREA 6: CITY WATERWAY

Natural Environment

The cumulative impact of proposed projects involving dredging within Subarea 6 will be the removal of some 10,200 cubic yards of material over a bottom area of approximately 1.6 acres (Table 6). The area dredged is primarily subtidal substrate near the mouth of City Waterway (1 acre); the remaining 0.6 acre is intertidal and shallow subtidal substrate in the inner portion of City Waterway past Wheeler Osgood Waterway. Sediment quality in all areas to be dredged is poor (Isakson and Loehr 1981; Malins et al. 1980). Resuspension of sediment-bound contaminants and subsequent dispersal and settlement may further degrade the generally poor sediment quality within Subarea 6. In the actual areas dredged, exposed sediments may be of higher or lower quality than materials removed.

Fill activities using both upland material and dredge spoils will remove approximately 1.3 acres of intertidal and shallow subtidal substrate between -7 feet and MHHW. The net shoreline loss will be about 100 feet (Table 6). Intertidal mudflat areas are uncommon within this subarea; Wheeler Osgood contains extensive flats and the head of City Waterway has a small amount. Loss of 1 acre or less may produce no observable effect on the biotic community but will likely cause a slight decrease in overall productivity within the waterway. The shoreline loss amounts to approximately 0.5 percent of existing shoreline within Subarea 6. These changes may slightly reduce feeding opportunities for juvenile salmonids in the waterway.

TABLE 6

PHYSICAL CHARACTERISTICS OF PROJECTS IN SUBAREA 6 - CITY WATERWAY[a]

Project Name	Dredging			Filling					Overwater Structures			Shore Treatment		Wetland	Marina
	Sediment Quality[b]	Volume (1,000 yds^3)	Bottom Area (acres)	Fill Source	Fill Quality[b]	Bottom Area Acres	Depths (feet)	Net Shoreline Loss (feet)	Floating (acres)	Fixed (acres)	Pile-driving	Type	Length (feet)	Loss (acres)	Slips Added
28. Superior Oil Dock and Dredging	Poor	5	1.0	--	--	--	--	--	--	--	Yes	--	--	--	--
29. Globe Machine Ramp and Float	--	--	--	--	--	--	--	--	<0.1	--	Yes	--	--	--	--
30. City Marina Expansion	Poor	4.8	0.5	Upland; rubble; spoils	Good to poor	1.2	-7 to MHHW	--	0.25	<0.01	Yes	Concrete rubble	700	(Intertidal only)	84
31. Dillingham Site Marina Expansion	Poor	0.4	<0.1	Upland; spoils	Good to poor	<0.1	MLLW to MHHW	<100	0.15	0.05	Yes	Piling	100	(Intertidal only)	45
32. Pick's Cove Covered Moorage	--	--	--	--	--	--	--	--	0.4	--	No	--	--	--	--
33. Dock Street Connector	--	--	--	--	--	--	--	--	--	0.5	Yes	--	--	0.006	--
34. City Waterway Marina Expansion	--	--	--	--	--	--	--	--	0.06	--	Yes	--	--	--	34
35. Union Depot Redevelopment	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
36. Tacoma Marina and Breakwater	--	--	--	--	--	--	--	--	--	No change	Yes	--	--	--	270
37. Navigation Channel Realignment	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Subarea 6 Totals	-- Poor	-- 10.2	-- 1.6	--	-- Good to poor	<1.3	-7 to MHHW	<100	1.0	0.5	Yes	--	800	<0.006	441

(a) Please see footnote (a) under Table 2.
(b) Quality is based on the known or suspected presence of toxic materials. Higher amounts of toxic materials decrease quality.
MHHW = mean higher high water
MLLW = mean lower low water

A major portion of proposed development activity in Subarea 6 is the construction of floating and fixed overwater structures. Approximately 1.8 acres of floating structures and 0.5 acre of fixed structures are planned along with piles required for support. This will remove approximately 2 percent of the existing 111 acres of surface area within City Waterway.

Shoreline treatment with concrete rubble (700 feet) and vertical wood piling (100 feet) will affect approximately 5.2 percent of existing shoreline within City Waterway. Cumulative impacts from this construction will probably be inconsequential in consideration of the existing developed shoreline within City Waterway.

Marina expansion or development within Subarea 6 will add 441 boat slips to City Waterway under the full development scenario. Cumulative impacts will include an overall lowering of water circulation and flushing rate within the waterway. Increased pollutant residence time due to poorer flushing and increased incidence of accidental spills of oil, gas, sewage, and other by-products of marina use will degrade existing water quality. The likely result will be a chronic, sublethal impact on benthic and pelagic species that will manifest itself as lowered productivity and poorer health over a long-term period. However, species normally associated with floating structures should show a net increase due to additional habitat availability.

Human Environment

All projects planned for the City Waterway subarea are consistent with land and water use plans and policies in effect in the area. The east shore of City Waterway south to the Wheeler Osgood Waterway is located in Shoreline District S-10, which has an associated plan concept calling for industrial use (see Chapter 8). The remainder of the City Waterway shoreline is located in Shoreline District S-8 (mixed public use). Project Nos. 28 (Superior Oil Dock and Dredging) and 29 (Globe Machine Ramp and Float) are located in, and are fully consistent with uses permitted under, Shoreline District S-10. The remaining nine projects (Nos. 30 through 37) are located in Shoreline District S-8 and represent permitted uses. Development of all projects in the City Waterway subarea will not alter the character of land and water use, although full development will involve an intensification of uses within the subarea.

The most significant cumulative land and water use impact associated with development of all identified projects in the City Waterway subarea is the addition of 441 additional recreational boat moorages, 163 of which will be developed in the landward end of the waterway. This will represent nearly a doubling of existing moorages in City Waterway, resulting in a high concentration of recreational vessels in the waterway on peak summer days, with associated potential for navigational hazard. Marina development and expansion will also generate relatively high peak traffic volumes along Dock Street, E. D Street, and other roads providing access to City Waterway. During peak hours, the surplus carrying capacity of the waterway and access roads may be substantially reduced. Interferences may occur between recreational and commercial vessels in the middle and outer waterway.

Public access to the City Waterway area will be improved through development of marinas and other public use areas such as the Union Depot Redevelopment (Project No. 35) and the upland commercial development as part of the Tacoma Marina and Breakwater (Project No. 36). Therefore, while some minor conflicts between recreational boats may occur, the net impact of full project development on recreational resources will be positive.

Cumulative noise impacts may result from concurrent construction of two or more projects, but operation of all projects should not substantially increase ambient sound levels in the subarea.

The visual character of the subarea will not be altered by development of all projects planned for City Waterway. Existing historic/cultural resources may be affected by development of two projects (Union Depot Redevelopment and Tacoma Marina); however, responsible project design should mitigate potentially adverse impacts on such resources and will, in fact, enhance the historic value of affected structures.

8. FULL STUDY AREA DEVELOPMENT

This chapter presents a brief overview of the general impacts that could be expected to accrue to the natural and human environments if the shorelines of the study area were fully developed in a manner consistent with existing land use plans. Growth and development within greater Tacoma is guided by a number of plans (see Section 2.0 of Johnston 1981). Several of these plans are relevant to the study area (see Johnston, pp. 84). However, the Master Program for Shoreline Development, City of Tacoma (Tacoma Planning Commission 1976) provides the most comprehensive guidelines regulating growth and development along the shores of the study area. Subsequent plans and policies adopted by the City of Tacoma reflect the guidelines and restrictions therein.

The general goal set forth for shoreline development in the plan has been described by Johnston (1981 pp. 115):

"The Master Program for Shoreline Development, City of Tacoma establishes a general goal for shoreline development, which is to:

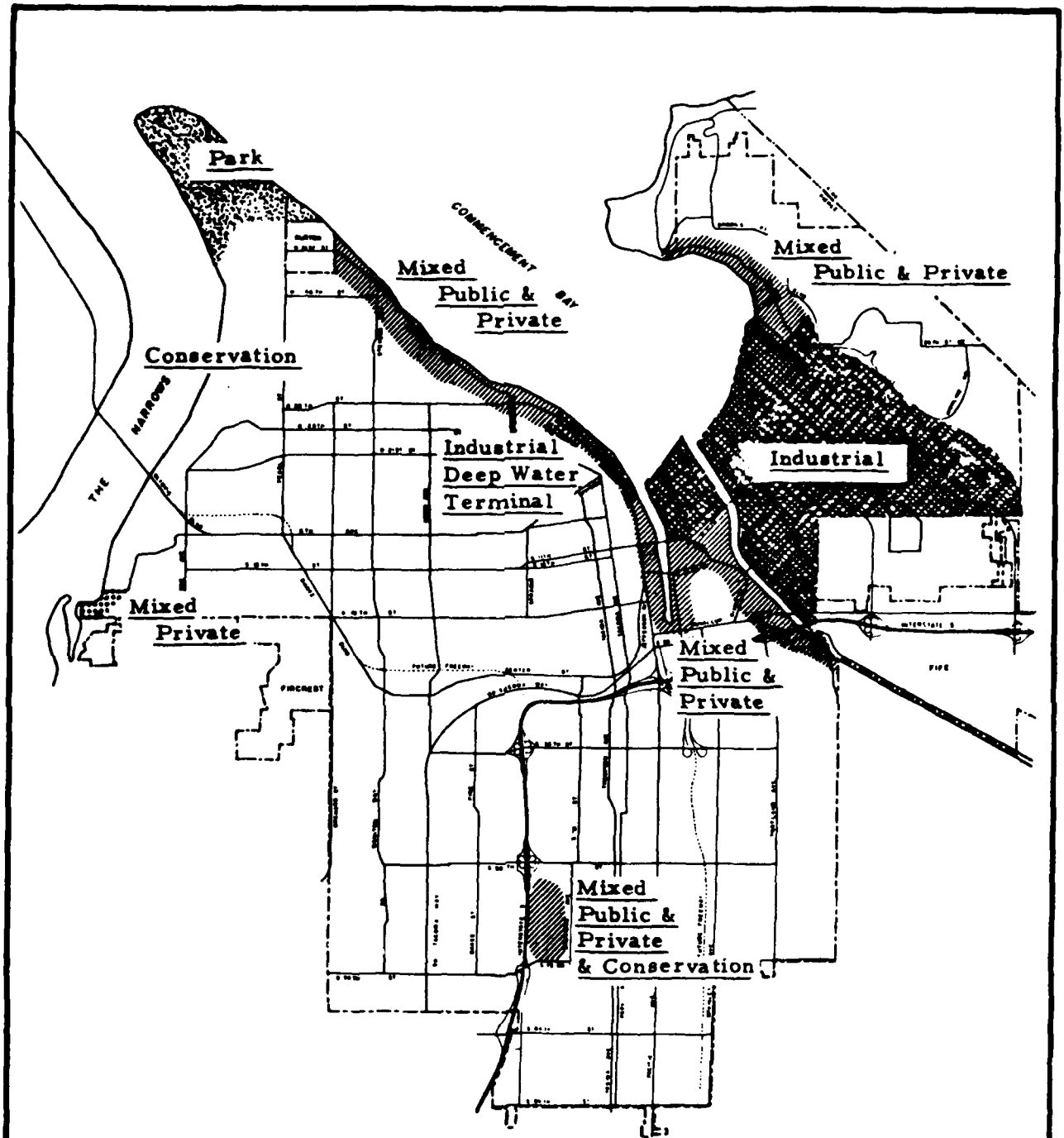
> 'develop the full potential of Tacoma's shoreline in accord with the unusual opportunities presented by its relation to the city and surrounding area, its natural resource values, and its unique aesthetic qualities offered by water, topography, views, and its maritime character; and to develop a physical environment which is both ordered and diversified and which integrates water, shipping activities, and other shoreline uses with the structure of the city.'

"Policies designed to achieve this goal are directed at public acquisition of shorelines pursuant to establishing a 'logical pattern' of public ownership, encouraging development of water-oriented uses on public and private shorelines, eliminating shoreline pollution, accommodating the growing need for aquatic recreational facilities, and encouraging joint public and private planning of city shorelines."

The master program establishes shoreline use regulations to:

(1) Provide a general plan concept for shoreline use.
(2) Define use regulations for designated shoreline segments.
(3) Provide for variances, conditional uses, and emergencies.

The General Plan Concept for Shoreline Use contained in the master program is depicted in Figure 7; shoreline segments are depicted in Figure 8. General use designations for shoreline segments located within the study area include:

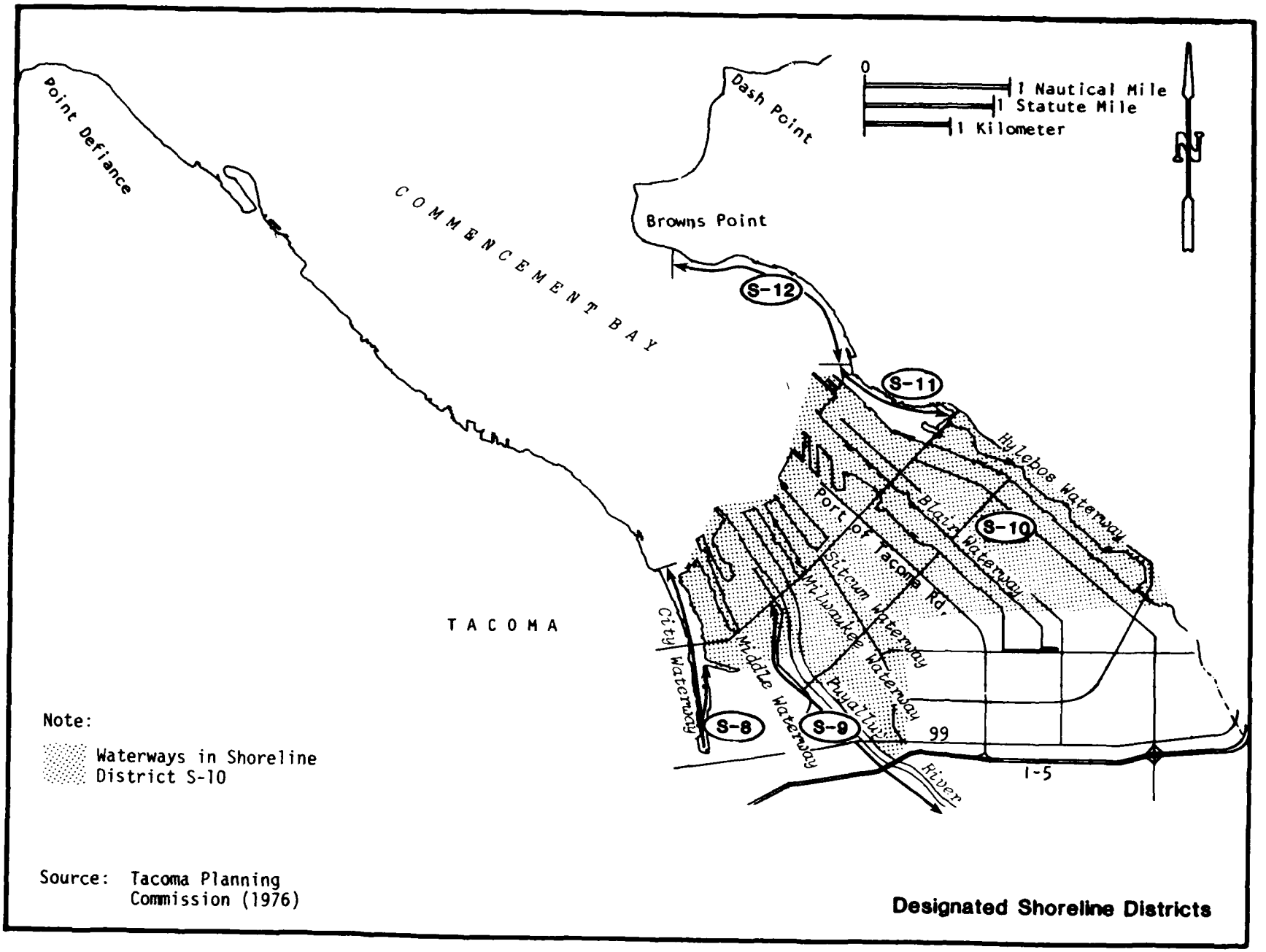


Note: Shaded areas are for clarity and do not represent exact areas of designation.

Source: Tacoma Planning Commission (1976).

GENERAL PLAN CONCEPT FOR SHORELINE USE

Figure 7



Designated Shoreline Districts

Figure 8

City Waterway (S-8)	Mixed Public and Private*
Puyallup River (S-9)	Mixed Public and Private*
Port Industrial (S-10)	Industrial and Terminal
Marine View Drive (South) (S-11)	Industrial
Marine View Drive (North) (S-12)	Mixed Public and Private*
Commencement Bay (Shoreline of (Statewide Significance)	Marine Navigation

Specific use activities permitted either outright or conditionally for each of the shoreline districts in the study area are summarized in Table 7. Description of the beach characteristics, upland topography, present use, environmental designations, and detailed information on permitted/conditional shoreline use activities associated with each of these districts are presented in the master program.

This discussion will assume future development consistent with the Master Program for Shoreline Development, City of Tacoma and as described above in Chapter 4 for each subarea.

THE NATURAL ENVIRONMENT

Full development of the study area is assumed to involve an intensification of permitted marine, shoreline, and upland uses with two major categories of associated impacts. The first category includes those actions that result in long-term or permanent habitat loss or modification. The second category includes short-term but perhaps recurrent (chronic) perturbations resulting from normal commercial, industrial, and recreational activities as well as from one-time accidental occurrences (e.g., major spills).

Habitat modifications will occur as one-time or phased projects that require fill or dredging of existing marine or wetland areas or construction of facilities that modify the character of the existing environment (e.g., wharves, bulkheads, marinas). Cumulative impacts of such actions can be mitigated somewhat through design and construction practices, or through replacement "in-kind" of altered or lost habitats. Compensation for such losses using other than "in-kind" measures is less acceptable to agencies, but may be appropriate in some instances where "in-kind" opportunities are limited. In any case, it is likely that all future projects with potentially significant impacts on natural systems will require some form of mitigation.

The projects considered in this study demonstrate that there will be growing pressure for developments that will further reduce certain types of habitats thought to be of importance to key biological resources (fish, invertebrates, birds). The availability of such habitats (e.g., mudflats, marsh areas, natural shorelines) has already been drastically

*Mixed Public and Private - Emphasis on public shoreline acquisition, for development of water-related parks, open space and recreation facilities, within limits of community desire and financial capacity. Private water-related uses subject to compliance with shoreline development policies, and design and performance standards (Tacoma Planning Commission 1976).

TABLE 7

USES PERMITTED IN SHORELINE DISTRICTS, CITY OF TACOMA[a]

Shoreline Districts Located in Study Area		Environmental Designation	Sustantial Development: Permitted Use (A); Special Consideration (B), Conditional Use (C) Activities																								
			Educational/ Archaeological	Navigational Aids	Passive Recreation	Aquaculture	Bulkheads	Commercial (Water-Dependent)	Dredging (Maintenance)	Marina and Boat Launch	Piers	Recreation (Water-Dependent)	Road Design, Construction	Utilities	Landfill	Port and Water-Related Industry	Residential, Upland Location	Railroad	Groins	Jetties	Non-Water-Related Industry	Water-Related Hotels/Motels	Shoreline Protection	Log Rafting, Storage	Breakwater	Dredging (Non-Maintenance)	Commercial (Non-Water-Dependent)
S-8	City Waterway	Urban	A			A	A	A	A	A	A	A	A	A	A		A	A				A			A	A	
S-9	Puyallup River	Urban	A			A	C	A	B	C	C	A	A	A	A	A		A	B	B			A			B	
S-10	Port Industrial	Urban	A			A	A	A	A[a] B[d]	A	A	A	A	A	A[b]	A		A	A[b] B[d]	A[b] B[d]	C		A	A[c]	A	A[b] B[d]	C
S-11	Marine View Drive South	Urban	A			A	A	A	A	A	A	A	A	A	A	A		A	A	A	B			A[c]	A	A	B
S-12	Marine View Drive North	Urban	A				A	A	B	A	A	A	A	A	B		A		C	C					B	B	

(a) Source: Tacoma Planning Commission (1976).
(b) Except in Puyallup River.
(c) For cargo handling purposes.
(d) In Puyallup River.

reduced in Commencement Bay. Despite our best efforts and intentions to mitigate present and future losses, there may well be a net decline in the carrying capacity of the industrial waterways for important species such as juvenile salmonids. Whether this decline would translate directly to reduced marine survival of anadromous salmonids is difficult to project and will depend on other factors such as availability of alternate habitat for early marine residency, compensatory nature of any mortality resulting from reduced habitat within the bay, enhancement and harvest patterns, etc.

Some potential "projects" within the study area may actually improve marine and wetland habitats. Efforts to better understand the nature and extent of sources of pollutants and toxicants present in the Commencement Bay area are beginning to be successful so that cleanup or containment can be achieved. If these efforts are successful, a continuation of the apparent recent trend toward improving water quality and perhaps sediment quality in the study area may result in healthier and more abundant biota. Major dredging projects have the potential for removing contaminated sediments, exposing cleaner underlying sediments that may contribute to this trend. This, of course, assumes that the contaminated sediments will be disposed of in a manner that reduces their environmental hazard (e.g., in a sealed landfill).

The second major category of impacts stems from recurrent activities associated with expanded commercial, industrial, and recreational use of the area. These activities include such things as periodic maintenance dredging, piledriving, wharf repair, vessel movements, and minor releases of petroleum products, sewage, and other potential pollutants. Individually these perturbations may be rather minor in extent and short in duration. Yet collectively, they will continue to degrade the suitability of Commencement Bay as a habitat for biotic resources unless they are individually controlled or mitigated for the good of the resource.

THE HUMAN ENVIRONMENT

Full development of the study area with a logical pattern of ordered and diversified uses permitted in the shoreline districts comprising the study area will have the potential for exceeding the capacity of existing infrastructure (local arterials and collector roads, storm and sanitary sewers, rail systems, etc.) serving the port industrial area.

Infilling and redevelopment to more intensive industrial uses within the port industrial area will generate substantial vehicle and vessel traffic. Such effects are likely to be most severe along Blair Waterway where relatively large parcels of vacant industrial lands and some waterfront are available for development. Development of the larger vacant parcels in the port industrial flats (Subarea 4) could also substantially reduce surplus carrying capacity.

Redevelopment of older industrial uses in the Hylebos Waterway and St. Paul/Middle waterways subareas will occur more slowly. Future development in these areas will primarily occur through infilling of the few remaining (and mostly smaller) vacant parcels, or through creation of

larger parcels for development through consolidation of older undeveloped parcels.

Existing plans and policies (including the City Waterway Policy Plan [Tacoma Planning Department 1974]) encourage the development of marinas and other public use areas along City Waterway. Development of additional marina uses, parks, and public access areas will generate vehicular and boat traffic with the potential of ultimately exceeding or severely decreasing the surplus carrying capacity of existing transportation systems.

The development of new and expanded infrastructure must keep pace with development of industrial, commercial, and public uses to minimize impacts on the human environment. Similarly, projects must continue to be assessed not only on the basis of their individual impacts on the human environment but also on the basis of the cumulative and sometimes synergistic effects associated with planned development in the subarea, subregion, and region.

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APPENDIX A

RESOURCE INFORMATION SYNTHESIS

GENERAL

This section presents a brief summary of information available from studies performed in the COBS study area in addition to the COBS I baseline studies. For the most part, the information synthesis herein addresses information available prior to January 1, 1983. However, activities associated with several relevant studies are discussed for the sake of continuity.

NOAA-MESA PUGET SOUND PROJECT

Future and ongoing studies conducted by NOAA-MESA are discussed in COBS I (Isakson and Loehr 1981, pp. 13 and 14). This list was updated through the NOAA/MESA Puget Sound Project Office (Long 1982). Studies covered in COBS I (e.g., Malins et al. 1980 and Riley et al. 1981) are not repeated here.

1. A Summary of Knowledge of Puget Sound Related to Chemical Contaminants: This summary was released as NOAA Technical Memorandum OMPA-13 dated December 1981 (Dexter et al. 1981). OMPA-13 used available data to characterize major physical, biological, and chemical features of Puget Sound, including Commencement Bay, and to provide descriptions of existing study area ecosystems. The summary is designed to present a rudimentary understanding of chemical contaminants in the basic ecosystem relationships. The overview presented therein is necessarily generalized based upon the limited data available at the time the summary was prepared.

2. Chemical Contaminants and Abnormalities in Fish and Invertebrates From Puget Sound: This report was released as NOAA Technical Memorandum OMPA-19 dated June 1982 (Malins et al. 1982). The report summarizes a Puget Sound data collection program including specific sites in the study area from 1978 through 1981. A substantial portion of this information was originally presented in OMPA-2 (Malins et al. 1980) which was included in the COBS I data summary.

   As described in the COBS I effort, this multiple-year study evaluated sediments and associated bottom fish and invertebrates from urban embayments and reference areas in Puget Sound and adjacent waters. Various inorganic and organic chemicals in sediments and biota were evaluated, and visible and microscopic abnormalities were examined in collected biota. Associated fish and invertebrate community structure was characterized.

   OMPA-19 provides valuable data about 25 specific locations, several of which are in the study area. This study provides the most pertinent available information on the impact of chemical contaminants on Commencement Bay as well as a contrast between locations within and outside of the COBS study area.

3. Effects, Pathways, Processes, and Transformations of Puget Sound Contaminants of Concern: This Konasewich et al. (1982) study (NOAA Technical Report OMPA-20) presented evaluations of the spectrum of known Puget Sound contaminants and documented the present level of understanding of the fate and effects of fifteen contaminants of environmental concern based upon their persistence, distribution, and toxicity.

The fifteen target contaminants or groups of contaminants addressed in the study were:

(1) Polychlorinated Dibenzofurans (PCDFs) and their possible precursors, tetra- and pentachlorophenol: Three PCDFs were detected in the sediments of central Puget Sound; levels were not determined.

(2) Chlorinated Butadienes: Chlorinated butadienes have been found in the sediments and biota of Puget Sound, with hexachlorabutadiene found in livers of sole in concentrations as high as 9.1 ppm.

(3) Polyaromatic Hydrocarbons (PAHs) and their Halogenated Derivations: OMPA-20 indicates that PAHs are widely distributed in the sediments and biota of Puget Sound, with especially high levels in Elliott and Commencement bays.

(4) Arsenic: High levels of arsenic were found in Puget Sound with sediments near the major anthropogenic source of arsenic (the ASARCO smelter on the south shore of Commencement Bay) containing up to 10,000 ppm. Sediments in other areas contained up to 640 ppm arsenic.

(5) Cadmium: Cadmium levels in sediments of central Puget Sound were highly elevated compared to regulatory criteria for classifying sediments, with concentrations as high as 18.3 ppm.

(6) DDT and its Metabolites: Concentrations of DDT and its metabolites were high in Puget Sound biota and sediments, with DDT dominant.

(7) Polychlorinated Biphenyls (PCBs): PCBs were found to be the most predominant contaminants in Puget Sound sediments and biota, with up to 440 ppb hexachlorobiphenyl detected in sediments and up to 15,000 ppb detected in fish livers.

(8) Hexachlorobenzene (HCB) and Other Chlorinated Benzenes: Up to 1,300 ppb HCB were detected in sediments and up to 3,700 ppb were detected in fish livers in Puget Sound.

(9) Chlorinated Ethylenes: The concentrations of chlorinated ethylenes in Hylebos Waterway of Puget Sound exceeded values reported in other marine environments. Volatility is a major fate process and concentrations of 3 ppb trichloroethylene, as observed in waters from the Hylebos Waterway, imply appreciable discharges of chlorinated ethylenes.

(10) Phthalate Acid Esters (PAEs): PAEs were found to be widely distributed throughout Puget Sound, with concentrations up to 1,600 ppb of one PAE reported in sediments. Much of the literature reviewed indicated that PAEs are probably not of environmental significance. One overriding concern is the possible chronic effects of low concentrations of PAEs, and data are unfortunately minimal, especially for marine species.

(11) Copper: Of 42 sediment samples from Puget Sound, only 14 had copper levels less than the 50 mg/kg "heavily polluted" classification by EPA for evaluation of dredged materials. Sediments with copper concentrations as high as 1,600 mg/kg were found in Puget Sound.

(12) Lead: Many of the sediments of Puget Sound were heavily contaminated with lead, generally indicative of marine sediments in the vicinity of heavily urbanized and industrialized regions. Concentrations up to 790 mg/kg were found in Puget Sound sediments. Insufficient toxicity data exist on the effects of lead on marine organisms to evaluate the implications of the levels found in Puget Sound.

(13) Mercury: Mercury concentrations in sediments from industrial areas of Puget Sound varied from 0.026 to 1.38 ppm. These levels may still be of biological importance, although mercury concentrations are probably decreasing in Puget Sound.

(14) Selenium: Selenium levels in most Puget Sound sediments were found to be much higher than expected background levels.

(15) Silver: Silver was found at high levels in several Puget Sound sediments and biota. Low levels of silver dissolved in water have been shown to be very toxic to aquatic organisms, and determinations of silver levels in Puget Sound waters are recommended.

For many compounds, data on fate and effects were virtually absent. These compounds included halogenated cycloalkenes, halogenated alkenes, dibenzothiophenes, and the metals, gallium and germanium.

4. Colonization Rates and Processes as an Index of Pollution Severity: This ongoing University of Washington study includes colonization data and analysis associated with three important areas in the study area (Hylebos, Blair, and Milwaukee waterways). A final report has not yet been released.

5. Survey of Biological Effects of Toxicants Upon Puget Sound Biota, Phase 1: This NOAA-MESA study was released as OMPA Technical Memorandum No. 25 (OMPA-25). This study evaluated 97 sites (37 in Commencement Bay) and challenged fish, crustacea, and worms in sediment lethal and sublethal bioassays. The following is taken from portions of the report's Executive Summary:

"A progression of tests ranging from lethal to sensitive sublethal were used to evaluate a total of 97 sediment and 7 bottom water samples from the following areas of Puget Sound: Elliott Bay and the lower Duwamish River, Commencement Bay and its Waterways, Sinclair Inlet, Port Madison (a reference site), and Birch Bay (a control site). Testing methods were chosen that were known to be responsive to toxic chemicals, such as those known to occur in Puget Sound. Lethality bioassays with an oligochaete (Monopylephorus cuticulatus), amphipod (Eogammarus confervicolus), and fish (threespine stickleback Gasterosterus aculeatus) using bottom water samples and slurries of Puget Sound sediments indicated no acute lethality in any areas tested with the exception of amphipod mortalities following exposure to sediment from one station off Denny Way Combined Sewer Overflow (Elliott Bay). The relative sensitivities of the test organisms were documented and confirmed by spiked sediment tests.

"Physical and chemical data for tested samples (temperature, salinity, and extractable organic matter for waters; particle size, total volatile solids, digestible organic carbon, and extractable organic matter for sediments) conformed to results of other studies of Puget Sound and did not provide a clear distinction among samples. Live benthic fauna were noted as part of a cursory visual examination in most of the benthic grab samples, including one station where amphipod mortalities were observed. Consequently, it appears that direct, rapid lethality is not a major factor for the majority of fauna exposed to and living in or near chemically contaminated Puget Sound sites [including Commencement Bay].

"However, the results of respiration and genotoxicity testing substantiate previous evidence of sublethal toxicant effects (e.g., liver neoplasia in bottom fish, benthic community changes) in Puget Sound biota from highly contaminated areas. Comparisons of the test results for both respiration and genotoxicity indicated generally very good agreement on broad scale toxicity patterns at different geographic areas. Comparison of these data with chemical data, other studies on mortalities of sensitive amphipod species, and results from the control and reference area, indicate that the approach taken in this study has successfully described various biological responses apparently related to chemical contamination.

"Study results were used to prioritize specific geographic areas of concern. On this basis, the most toxic tested areas of Puget Sound were: near the Denny Way CSO (Elliott Bay); and City, Blair, and Hylebos Waterways (Commencement Bay). Other tested areas which showed strong biological effects (in descending rank) were: upper Duwamish, Sinclair Inlet, outer Elliott Bay, outer and inner Commencement Bay and East Duwamish Waterway. The control site (Birch Bay) and reference site (Port Madison) were among the least toxic areas but did exhibit some effects. The inference is made that subtle adverse effects previously observed in field surveys occur among Puget Sound fauna associated with the areas shown in the present laboratory study as having the greatest demonstrable biological effects."

6. Circulation and Suspended Matter in Commencement Bay: This study (1) characterizes physical transport processes in Commencement Bay involved in the movement and fate of contaminants (available as OMPA-22), and 82) determines typical suspended particulate matter loads of the bay and horizontal/vertical transport and textural and compensational characteristics of the suspended particulate matter (available as OMPA-26).

7. Deep Water Cores from Commencement Bay: This study contains analyses of cores from deepwater sites in Commencement Bay. Since this NOAA-MESA study analyzed cores from the open waters of the bay (located outside of the study area), it is likely that data in this report will have limited usefulness in the COBS II analysis. Such data may be useful in determining the impacts associated with any proposed dredge disposal in the study area to open bay disposal areas.

8. Synthesis of Puget Sound Current Meter Records: Currents in Puget Sound are analyzed and synthesized in this three volume NOAA-MESA study. Volume I (index) is currently available. Volumes II (measures of mass and energy inputs to Puget Sound) and III (interpretation of currents, water properties, and inputs) may be published in 1983.

   Data in these reports are general and address currents in Commencement Bay proper and not the industrial waterways.

9. Pathways of Contaminants in Commencement Bay and Approaches: This NOAA-MESA study represents a conceptual framework based on a synthesis of historical data. This one-year study was contracted on June 15, 1982 to determine whether Commencement Bay is a source or sink for contaminated suspended particulate matter.

   This study will not be available in time to be incorporated into the COBS II analysis and, like others discussed previously, will likely provide only general coverage of Commencement Bay rather than focusing on the industrial waterways.

10. History of Contaminants in Sediments in Commencement Bay, Tacoma: This study will analyze sediment age, rate of accumulation, and contaminant concentration with time based on a synthesis of data on existing cores and related data that have been previously collected in Commencement Bay. Subbottom profiling completed by EPA Region X will also be incorporated into these evaluations. Core data from deeper water areas of Commencement Bay also will be compared with East Passage and Quartermaster Harbor. This report will present only limited data relevant to the COBS II effort since it deals with deep water sites in the bay. It is anticipated that data in this report will assist the evaluation of impact associated with any proposed disposal of dredge spoils (from the study area) in designated spoils disposal sites in the open waters of Commencement Bay. A draft report of these studies was made available for NOAA Headquarters review in early 1983. A final report will be prepared upon completion of the ongoing review.

11. Survey of Biological Effects of Toxicants Upon Puget Sound, Phase 2: This NOAA-MESA study is a follow-up study to NOAA-MESA's Phase 1 survey of biological effects of toxicants (Report No. 5 above). The Phase 2 study presents data on a broader set of biological tests at 10 sites in Commencement Bay. A report has been sent to NOAA Headquarters for final review and publication. The data in this study generally are consistent with toxicity trends observed in Phase 1 (Long 1983). Impairment of reproductive capabilities was observed in selected organisms.

12. Statistical Relationship Between Fish Disease Data and Fish Tissue Chemistry Data: This completed NOAA-MESA study (Zeh 1982) used data from Malins et al. (1980) and Malins et al. (1982) in statistical tests to determine relationships (if any) between selected histopathological disorders in bottom fish and the occurrence/concentration of contaminants in the fish tissues.

    The letter report (received August 1982) indicated that such a relationship existed for PCBs and summed pesticides, but could not establish a similar relationship for heavy metal or aromatic compounds.

    The relationship identified in this study will provide information that will supplement the project impact analysis associated with the COBS II study effort.

13. Distribution of Contaminants in Colvos Passage and South Puget Sound: This ongoing study presents a comparison of sediments from areas in Colvos Passage and south Puget Sound with those of Commencement Bay. While of general interest, this study does not appear particularly relevant to the COBS II study effort due to the distances between the target areas and the COBS study area. A report will soon be sent to NOAA Headquarters for final review and publication.

14. Distribution of Breeding Marine Birds in Puget Sound and Chemical Concentrations in Tissue: This ongoing NOAA-MESA study assesses concentrations of chemical contaminants in bird tissues in the Puget Sound area (including Commencement Bay) relative to those previously found in lower trophic level animals. The results of these evaluations will become part of Report No. 13.

15. Occurrence of Contaminants in Puget Sound Harbor Seals: This study is designed to provide an overview of contaminant levels in harbor seals using south Puget Sound and therefore should be of only limited use in the COBS II effort. This study summarizes existing information supplemented with new chemical data obtained from the tissues of 30 "animals of opportunity." A draft report may be available to the public in late 1983.

16. Frequency of Occurrence of Histopathological Disorders in Fish: This ongoing study is designed to determine year-to-year trends, if any, in the frequency of occurrence of selected disorders in selected bottom fish. Recently collected 1982 data will be compared with 1979 and 1980 data in OMPA-2 and OMPA-19 reports (Malins et al.

1980, 1982). In 1982, a new station at the mouth of Milwaukee Waterway was added to the original two bottomfish stations being studied in Commencement Bay. The 1982 study is not intended for publication. NMFS will perform a 1983 survey at the same stations. The results of a comparative analysis of 1979, 1980, 1982, and 1983 data may be published in 1984.

17. Estimated Recovery Rates of Commencement Bay: This 2-year study was initiated in mid-1982 to evaluate recovery rate(s) of Commencement Bay assuming existing reservoirs or sources of contaminants are removed. The final report will not be available from NOAA until late 1984.

18. Amphipod Sediment Bioassay Evaluation: A study nearing completion (Ott et al. 1982) evaluated a new amphipod bioassay technique using 17 Puget Sound sediments (7 from Commencement Bay). Sublethal responses were identified and demonstrated to be important considerations in future amphipod bioassays.

19. Fish-Benthos Coupling in Sewage-Enriched Marine Environments: This study is nearing completion under a NOAA-OMPA grant to the University of Washington. This study includes four study sites located within the study area, and two sites located just outside the study area (just north of Browns Point). Study data available to date (in the 18-month draft Progress Report [Chew and Becker 1982]) provide relationships of fish distributions to both substrate type/depth as well as to invertebrate fauna. A final report is due on January 15, 1983.

20. Relationships Between Sediment-Associated Xenobiotics and Biological Anomalies in Puget Sound: This is a recently initiated, 2-year study undertaken by the National Marine Fisheries Service (NMFS). The purpose of this study is to determine which chemicals can cause biological effects at their existing levels in Puget Sound sediments. Study results will be obtained by (1) spiking clean sediments with chemicals and completing toxicity tests conducted on the mixtures, and (2) testing the toxicity of fractions of chemical extracts of sediments from West Duwamish Waterway and Upper Hylebos Waterway.

U.S. ARMY CORPS OF ENGINEERS (COE)

Blair/Sitcum Waterway Studies: The U.S. Army Corps of Engineers, Seattle District, has evaluated Blair and Sitcum waterway sediments by toxicity bioassays (Pierson et al. 1983). Sediments were collected at 5 sites in Sitcum Waterway and 3 sites in Blair Waterway. Sediment bioassays were completed on juvenile chinook salmon, Pacific oyster larvae, and Paraphoxid amphipods with established flow-through bioassay techniques.

Conclusions and recommendations by authors are as follows (Pierson et al. 1983, p. 42):

"1. Survival of chinook salmon (Oncorhynchus tshawytscha) smolts was not affected by exposure for 96 hr to continuously flowing elutriates

(1.0 part per thousand) prepared from sediment collected from sites S-1, S-2, B-1, B-2, B-3, and B-5 from Blair and Sitcum Waterways, Commencement Bay, Tacoma, Washington.

2. Data describing the 96-hr survival of chinook salmon exposed to elutriates prepared from sediments from sites S-3, B-4, and B-6 were confounded by control mortalities and hence, were not reported.

3. Shell formation was altered in oyster (Crassostrea gigas) larvae exposed for 48 hr to water decanted from defrosted sediment samples from sites S-2, B-2, B-3, and B-5.

4. Shell formation of oyster larvae was not affected by 1:5 dilutions of elutriate prepared from sediment from any of the sites (WB, S-1, S-2, S-3, B-1, B-2, B-3, B-4, B-5, and B-6). These data suggested that if the water described in number three above were diluted 1:5 with ambient seawater, shell formation of oyster larvae would be normal.

5. Dredging techniques that dilute the interstitial water and elutriates prior to entry into Commencement Bay are recommended to avoid potential toxicity. A dilution of 1:1000 was shown to be safe for salmonids; concentrations greater than 1:1000 (which were not tested) could be toxic to salmonids and other fishes.

6. Survival of the phoxocephalid amphipod, Grandifoxus grandis, was not affected by 204 hr exposure to sediments collected from any of the sites (WB, S-1, S-2, S-3, B-1, B-2, B-3, B-4, B-5, and B-6).

7. The above data suggest that sediments collected from Blair and Sitcum Waterways do not produce acute toxicity under the defined experimental conditions if sufficiently diluted. Absence of acute effects does not imply that chronic or sublethal biological effects (such as bioconcentration) may not result.

8. Blair and Sitcum Waterway sediments are known to contain significant concentrations of toxic chemicals (Malins et al., 1980; Riley et al., 1981). If these sediments (or significant amounts of undiluted elutriates originating from these sediments) were to become available to aquatic organisms, chronic bioassays using Commencement Bay water should be conducted to assess the potential of bioconcentration of the toxic chemicals in organism tissues.

9. Should the Corps of Engineers elect to do bioassays involving Commencement Bay sediments for future projects, these bioassays should be done on site using Commencement Bay water. Amphipod bioassays should not be used to evaluate potential chemical toxicity of dredged sediments until additional research explains such biases as starvation, anoxia, and particle size-associated mortalities. Because mortality was not observed in amphipod bioassays done for this study, these tests did provide useful data."

In general inconsistencies exist between amphipod bioassay procedures and results completed by investigators working with Commencement Bay

sediments. Some believe that these inconsistencies primarily are due to variations in sensitivity of amphipod species and/or differing bioassay methods employed by different investigators. Others feel that vertical and horizontal heterogeneity in sediment characteristics have resulted in varied toxicity test results. Definitive resolution of variations in amphipid bioassay results has not been achieved.

Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) - "Superfund": Under Superfund (Public Law 96-510), "the Corps will serve as the federal agency managing design and construction activities associated with remedial action at hazardous waste sites designated for cleanup by the EPA pursuant to the Interagency Agreement beween EPA and the Corps of Engineers dated February 3, 1982. The Corps will also assist EPA in review of state-managed projects as to their suitability for bidding, constructing, and operating."

The Corps participation to date in Superfund has been directed at two areas of Commencement Bay, the deepwater area and the nearshore/tideflats area. Preliminary discussions have occurred between the Corps and EPA Region X to outline potential Corps assistance in data review and remedial investigations of the deepwater area. The Washington Department of Ecology (DOE) has entered into a cooperative agreement with the EPA to act as lead agency in implementing the Phase 1 investigation for the nearshore/tideflats Superfund site. The Corps plans to conduct a feasibility analysis of alternative dredging methods in support of this effort. (Please refer to discussion of Superfund activities under EPA and DOE sections that follow.)

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

In addition to joint efforts with DOE described above, several other studies sponsored solely by EPA are either underway or have been completed since COBS I.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) or Superfund: Under Public Law 96-510 enacted on December 11, 1980, broad federal authority was established to "respond to releases or threats of releases of hazardous substances, pollutants or contaminants from vessels and facilities. The government may take response action under circumstances prescribed by the Act whenever there is a release or a substantial threat of a release of a hazardous substance, there is a release or a substantial threat of a release of other pollutants or contaminants which may present an imminent and substantial danger to public health or welfare (section 104). Depending on the nature of the release or threat of release, the government may undertake short-term cleanup actions, long-term actions consistent with permanent remedy, or both." (47 Fed. Reg. 10,972 [1982]).

The Commencement Bay Superfund site was established by its inclusion on the Interim National Priority List (NPL) in October 1981.

As part of the Superfund effort, EPA supported a Commencement Bay Remedial Response Fact Sheet (U.S. EPA, Region 10 et al. 1982). This January 1982 study by EPA (with contributions by both DOE and the Tacoma-

Pierce County Health Department), evaluated general areas in and near the study area and presented a plan of action for each area to obtain information to define an actual remedial action plan. This study provided an overview of studies to date in each area, as well as a general summary of ownership and jurisdictional authority in each area. The areas evaluated included: (1) the nearshore, (2) the tideflat industrial area (3) the deepwater area of Commencement Bay (which includes the open bay area of the COBS I study area, and (4) the south Tacoma channel area, which is located outside of the COBS I study area and includes Nalley Valley. Areas 1 and 2 include the COBS II study area.

The Nearshore/Tideflats subarea of the larger Commencement Bay site was added to the NPL in December 1982. This subarea includes the industrial waterways of Commencement Bay (the COBS study area) as well as the Ruston shoreline and Town of Ruston.

Interagency meetings were held in early 1983 to define a study plan for the Nearshore/Tideflats area of Commencement Bay. These workshops led to a Cooperative Agreement between EPA and the WDOE. This agreement authorizes the allocation of $1.3 million in federal funds by EPA to WDOE to conduct a 16-month study. The purpose of this study is to investigate and determine the feasibility of cost-effective cleanup methods and will support possible cost-recovery efforts from identified pollutors.

EPA, via consultant, prepared draft work plans and a preliminary draft bibliography for the Nearshore/Tideflats area.

A Technical Oversight Committee was also established to provide technical review of the Nearshore/Tideflats Superfund efforts. The committee is generally comprised of representatives of federal and state agencies including the Corps.

Refer to the discussion of the Washington DOE's Superfund effort, following this section.

Commencement Bay Sediment Bioassay and Amphipod Distributions: A draft manuscript prepared by Swartz et al. (1982) reports the results of sediment bioassays taken in the open waters of Commencement Bay. Study conclusions from this manuscript are as follows:

"1) Sediment from central Commencement Bay near and between the two designated disposal sites was not acutely toxic to the infaunal amphipod, Rhepoxynius abronius.

"2) There was a great range in sediment toxicity within each of the major Commencement Bay waterways. Both highly toxic and nontoxic samples were collected from different parts of the Hylebos, Blair, Sitcum, and City Waterways.

"3) Sediment toxicity had a patchy distribution in the waterways Habitat differences, sedimentation rates, proximity to contaminant sources and sinks, and disruption of the seabed by prop scour and dredging could contribute to this patchiness.

"4) Our data show a correlation between amphipod distribution and sediment toxicity. Amphipod density and species richness are lower in the waterways than in the central Bay. Phoxocephalid amphipods are ubiquitous in the Bay, but absent from the waterways.

"5) This correlation between laboratory and field results indicates the ecological relevance of the sediment bioassay." (Swartz et al. 1982)

As referred to earlier, under the U.S. Army Corps of Engineers, these data are inconsistent with data obtained in Pierson et al. (1983) in assessing sediment toxicity to amphipods in the waterways of Commencement Bay.

Chemical Contaminants in Edible, Nonsalmonid Fish and Crabs from Commencement Bay, Washington: EPA collected 90 samples of bottomfish and crabs and analyzed their tissue for the presence of a variety of chemicals and heavy metals (U.S. EPA, Region 10 1982) . Results of the analysis will be furnished to the Tacoma-Pierce County Health Department. The EPA findings will complement a study already done by the department on fish consumption. The report addresses such questions as who catches the bottomfish and whether the fish are a regular dietary component. Using EPA data, the health department can decide whether to renew previously issued warnings about eating fish, whether to cancel the warnings, or whether to issue stronger warnings. (The chemical contaminants report was received too late for analysis.)

Commencement Bay Sediment Analysis: This study was conducted by EPA to obtain additional data on the contaminants in the deepwater bottom sediments. The results are presented in a data report to complement evaluations of Commencement Bay contaminants. Deepwater water sediment samples were collected from 46 locations in Commencement Bay in mid-September. Samples were analyzed for approximately 150 different chemicals and heavy metals considered by EPA to be of priority importance. Evaluation of the results has not been completed; therefore, no data synthesis is available.

An Evaluation of the City of Tacoma 301(h) Waiver: The City of Tacoma applied for a Section 301(h) waiver for the city's Sewage Treatment Plant No. 1 (STP 1). EPA (headquarters) has denied the request for waiver, basing its rejection on prevailing environmental and oceanographic conditions in Commencement Bay. The city has retained a consultant (Parametrix, Inc.) to conduct further studies in support of a new waiver application by the city. Decisions as to the level of treatment of STP 1 effluent may modify water and sediment quality near the mouth of the Puyallup River and in the nearshore/tideflats area of Commencement Bay in general.

WASHINGTON STATE DEPARTMENT OF ECOLOGY (DOE)

Class II-Receiving Water Studies: Several Class II studies and receiving water studies conducted by DOE to characterize the quantity and quality of discharges from study area industries have become available since COBS I baseline studies were completed. A few of the studies were available for incorporation in the COBS I baseline studies, but are included for

continuity. Class II and receiving water reports available for review as of mid-December 1982 are presented in Table A-1 along with preliminary summary of results.

Point Source Evaluations: DOE sampled water quality during two periods in 1982 to further evaluate primary point sources in Commencement Bay. Conventional water quality parameters were measured at approximately 25 different water sources between July 1981 and April 1982. Stations were selected based upon previous point source water/sediment quality evaluations by DOE, in cooperation with EPA. Intertidal sediments were also collected at most of these stations with all subjected to amphipod bioassay (Swartz et al. 1982). Priority pollutant scans were conducted on 13 sediment samples. At present, the analyses are complete, but several study evaluations, including calculations of loading from these sources and report preparation, are incomplete. A DOE report is anticipated in early 1983.

Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) - "Superfund": In mid-April 1983, DOE signed a cooperative agreement with the EPA to undertake studies in Commencement Bay.* (Refer to the Superfund discussion under EPA above.) The 16-month studies are now underway. Under this agreement, DOE has assumed major responsibility for the management and ultimate performance of the Superfund effort in Commencement Bay.

A Technical Oversight Committee, consisting of federal and state agency representatives, has been formed to provide technical review of the nearshore/tideflats Superfund effort.

DOE selected a consultant to manage the Superfund studies in Commencement Bay in June 1983 and is currently in the process of implementing the technical scope of Superfund services for the Nearshore/Tideflats area, which will include:

- Developing preliminary remedial objectives (decision criteria).
- Determining the type and extent of contamination and experience pathways.
- Determining sources of contamination and characterize as a current or historic source.
- Providing support to the human health assessments (pathways between contamination in biota, water column, and sediment and humans) to be performed by Tacoma-Pierce County Health Department and other agencies.
- Identifying potential remedial technologies.

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*The Nearshore/Tideflats area subject to Superfund studies includes the COBS II study area as well as the south shore of Commencement Bay (Ruston Way/Schuster Parkway) and the Town of Ruston.

TABLE A-1

WASHINGTON STATE DEPARTMENT OF ECOLOGY
CLASS II INSPECTION RESULTS

Industry Monitored	Date of Test	Summary of Results[a]
Hooker Chemical	September 25-26, 1979	Effluent concentrations were diluted in Hylebos. Even without dilution, concentrations were all below criteria levels for protection of marine life. Concentrations of Hexachlorobenzene (carcinogen) may be sufficiently high to create problems, even with dilution.
Reichhold Chemicals	April 21-22, 1981	General: Wastewater treatment facility at Reichhold appeared to be operating well. During the monitoring period, little or no direct discharge of Reichhold effluents to inner Commencement Bay occurred. Wastewater Discharge COD may be a problem; approaching permit limitations. Formaldehyde in treated effluent commonly fell within or above California State Water Quality Control Board criteria. Phenol, chlorinated phenol, and phenol derivitive compounds were found in wastewater flows. Pentichlora-phenol was very high (3 to 60 times the EPA criteria for protection of aquatic life). Relatively high concentrations of molybdenum, ammonia were measured in wastewater stream. Nearby Drains Alexander: Exceeded "not to exceed anytime" EPA criteria for zinc, lead, copper, cadmium, and mercury. Lincoln: Exceeded "not to exceed anytime" EPA criteria for copper and cadmium. "Note to exceed as a 24-hour average" exceeded for most metals in all freshwater stations.

(a) Summaries are derived from DOE reports (Yake 1980, 1981a, 1981b, 1982a, 1982b, 1982c), and Johnson and Prescott 1982a, 1982b, 1982c, and 1982d).

Industry Monitored	Date of Test	Summary of Results
St. Regis	August 11-12, 1982	TSS and BOD were marginal. Thermal impacts may become a factor, particularly if additional thermal impact is added. St. Regis is the primary source of chloroform loading in Commencement Bay. Although no criteria for chloroform have been developed, measured chloroform was acute and represented the highest loading for an organic priority pollutant noted in sources monitored by DOE to date (1800-1900 µg/L in wastewater with 50 µg/L demonstrated to cause mortality in oyster larvae). Acenapthene, a priority pollutant was also noted in high concentrations. Relatively high levels of copper and arsenic were noted; arsenic source is unknown. St. Regis may contribute to elevated ambient receiving water temperatures.
Sound Refining	June 30, 1981	Compounds in highest concentration in sediments were polycyclic aromatic hydrocarbons (PAH), phthalate acid esthers (PAE) and PCBs. No criteria have been established for these contaminants in sediments. Copper levels were also elevated. Relatively high pentachlorophenol and cyanide levels in effluent may be significant, although not detected in receiving environment. Cyanide levels were well above the criteria recommended to protect marine life. The Class II Report has not been prepared to date.

TABLE A-1

Industry Monitored	Date of Test	Summary of Results
U.S. Oil and Refining	May 5-6, 1981	U.S. Oil effluent was well within NPDES permit limitation. U.S. Oil effluent was found to be relatively free of organic priority pollutants, yet a dozen were detected in the discharge of Lincoln Avenue drain. U.S. Oil has very low metals concentrations associated with the waste stream and receiving waters. Concentrations of bis (2-ethylhexyl) phthalatc (DEHP), a plasticizer, were very high at the mouth of Lincoln Drain South; other priority pollutants were also noted in the drain (1,4 DCB and 1,2 PCB isomers). Sources of these organics are not known.
Pennwalt Corp.	June 2-3, 1981	Relatively high levels of bromoform were noted in the effluent; however, no criteria for bromoform have been established. Potential chlorine problem exists, with concentrations of about 125 times the EPA receiving water criteria of .002 µg/L noted. Possible leaks of caustic system to drum were noted, causing elevated temperatures. High pH values are associated with the wastewater stream and in seeps. Elevated arsenic levels were noted; copper has measured in excess of EPA criteria in nearshore waters; however, copper levels are only 10 µg/L higher at the outfall than at the intake. Along shoreline immediately below Pennwalt seeps and storm sewers, arsenic, lead, mercury, and zinc (in addition to copper) were at levels considered potentially harmful to marine life (as of Sept. 1980).

Industry Monitored	Date of Test	Summary of Results
City of Tacoma STP-1	August 25-26, 1981 February 16-17, 1982	STP 1 is typical of other municipal wastewaters with the primary exception of chlorinated phenols, which are substantially higher than in other plants. Chromium, cadmium, nickel, lead and probably arsenic are elevated when compared with other wastewaters and sludges in Washington State. Effluent mercury concentrations during the low-flow survey were well above EPA criteria. During the storm-flow period, metals and several priority pollutants (cyanide, tetrachloroethylene, and chlorinated phenols) were substantially higher than in low-flow periods. "Slug" load potential from industries is substantial. With dilution in the river, all pollutants likely do not exceed in-stream criteria with possible exception of mercury, cadmium, and lead. Low flows with coincident high tides hinder dilution. Primary treatment at STP 1 does not appear very effective in reducing priority pollutant concentrations. The receiving water study is in internal review and has yet to be made available to the COBS II effort. The receiving environment studies found stagnation occurs for several hours in Puyallup River flows when flows of 1,790 cfs or less coincide with tide heights over 11 feet. This flow and tide condition occurs frequently during late summer and fall. Even in stagnation periods when 10 of the 14 organic priority pollutants detected reached quantifiable levels, no EPA criteria were exceeded. Several organic contaminants in sediments below the outfall was attributed to STP 1.

- Conducting a feasibility study for remedial action directed at developing and evaluating cost-effective alternatives for remedial action.

- Developing conceptual design of remedial actions.

PORT OF TACOMA

The Port of Tacoma has conducted three studies relevant to COBS II. A fourth study, underway at present, will provide more fisheries data that will focus on the industrial waterways under port control.

Comprehensive Development Plan, Port of Tacoma: Completed in April 1982, this comprehensive plan for the Port of Tacoma was prepared for the Port by Tippetts-Abbett-McCarthy-Stratton (TAMS 1982). The plan provides port development scenarios to the year 2000. These scenarios are based on long-range trade forecasts, port development goals, and development constraints. The plan calls for phased modification of existing port facilities to accommodate new port facilities and capabilities. Specifically, the plan calls for development to occur as follows:

(1) Filling of Milwaukee Waterway to create sufficient area to support a modern container cargo terminal by approximately 1990. Alternatives to this proposal are also presented.

(2) Phased development/modification of public port facilities, including:

  - Phase 1. Extension of Terminal 4 to provide a total berth length of 1,800 feet and storage area of 48 acres, sufficient to handle one Panamax Roll-on/Roll-off (RO-RO) or container vessel and one general cargo/combination ship. Landfilling of the existing Fish Boat Haven area. Completion by 1985.

  - Phase 2. Retirement of Piers 1 and 2 and fill Slip 1. Construction of 2,000 feet marginal wharf on the existing pier head line to be completed by 1995.

  - Phase 3. (Assumes relocation of United Grain Gallery.) Filling of Pier 5 area to provide additional open storage space to completed by 2000.

  - Phase 4. Construction of extension to Berth D, Terminal 7 to provide additional 900 feet of berthing face to be completed beyond 2000.

(3) Expansion of port grain handling capacity from 7.6 to 8.3 million tons per year by the year 2000. Alternatives for expansion are also presented.

(4) Possible replacement of tallow storage facilities by the year 1990.

(5) Expansion of the Pierce County Terminal in Blair Waterway to accommodate a 3 to 4 percent annual growth in automobile and light truck imports through year 2000 to be completed by early 1990s.

(6) Addition of 1 berth at the Pierce County for break-bulk cargo to be completed by the early 1990s.

These proposed modifications will involve extensive reconfiguration of land and waterways within the port industrial area. For the purposes of the COBS II efforts it is assumed that all recommended modifications will occur (Kucinski 1983).

Milwaukee Waterway Baseline Studies: The Port of Tacoma contracted with Dames & Moore in 1982 to conduct a field study involving juvenile salmonid sampling (beach and purse seine) at five sites in Milwaukee Waterway and a control station in Middle Waterway. Infaunal and epibenthic invertebrates was sampled at three stations. Results indicated the predominant fish species taken was chinook salmon (89.7 percent) with coho, pink, and chum salmon taken in much smaller numbers. Many of the chinook and coho were from hatcheries in the Puyallup River system. The Milwaukee Waterway, especially near its mouth, was heavily used by juvenile chinook salmon, probably due to the waterway's proximity to the Puyallup River. Comparable epibenthic and infaunal invertebrates were taken in 1982 as in previous studies. Resident marine fish were also taken incidentally with gear types not focused on these species. Species of marine fish taken included starry flounder, staghorn sculpin, perch, and snake pricklebacks.

Milwaukee Waterway EIS Evaluations: The Port of Tacoma has applied for a Department of the Army Section 10/404 permit to fill Milwaukee Waterway to create additional land for planned containerized storage use.

An environmental impact statement (EIS) is in preparation to meet the requirements of the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA). The Corps of Engineers is the lead NEPA agency and supervises and coordinates the federal aspects of the environmental impact statement (EIS). The Port of Tacoma is the lead SEPA agency. In this role, the port is undertaking environmental assessments in support of EIS preparation. These assessments will be based in large part on the COBS I baseline studies, the Milwaukee Waterway baseline studies, the COE Blair/Sitcum sediment bioassay studies, and other relevant studies discussed previously in this chapter. It is unlikely that substantial new baseline data will be developed as part of the Milwaukee Waterway EIS effort. The assessment sponsored by the Port of Tacoma will provide alternative development scenarios for Milwaukee Waterway as well as evaluations of mitigation alternatives.

Additional Baseline Studies: In March 1983 the port contracted with the Fisheries Research Institute (University of Washington) and a private consultant, E.O. Salo, to perform juvenile salmon investigations using beach seine and tow netting techniques, with a focus on Milwaukee, Sitcum, and Blair waterways. This effort is in cooperation with the ongoing Puyallup Nation beach seining program. Data from these studies will be available from these studies in late 1983.

PUGET SOUND AIR POLLUTION CONTROL AGENCY (PSAPCA)

Puget Sound Air Pollution Control Agency (PSAPCA), a member of the Commencement Bay Air Work Group under Superfund, is currently assisting the Tacoma-Pierce County Health Department in conducting studies of the air quality impacts of the ASARCO smelter. PSAPCA is currently undertaking a joint venture with DOE to establish ambient monitoring sites for measuring arsenic emissions from the smelter. PSAPCA is also reviewing EPA's proposed standards for arsenic under the National Emission Standards for Hazardous Air Pollution (NESHAP), and will present recommendations at an EPA public hearing scheduled for late August 1983.

TACOMA-PIERCE COUNTY HEALTH DEPARTMENT

The Tacoma-Pierce County Health Department is actively cooperating with EPA and DOE in the ongoing Commencement Bay Superfund effort, and is currently sponsoring several studies directed at assessing pathways of pollutants in the study area. The department is also conducting a "ditchwalker" effort in which department personnel are cataloging point source inputs to the Commencement Bay tideflats. Other efforts by the department have been directed at determining health risks to man from air inhalation and food ingestion. Some of these evaluations have lead to public warnings about health risks in the area. The Tacoma-Pierce County Health Department is a member of the Commencement Bay Superfund Air Work Group (along with PSAPCA, Seattle-King County Health Department, EPA, DOE, and the Washington Department of Social and Health Services (DSHS).

PUYALLUP NATION

The Fisheries Management Division, Puyallup Tribal Fisheries Division, conducted juvenile salmonid sampling in the study area from 1979 through 1982. COBS I presented results of all work (reports and catch data) made available from 1979 through 1981.

The Port of Tacoma Milwaukee Waterway baseline study (Dames & Moore 1982) assessed relevant Puyallup 1982 sampling stations data. The Puyallup Nation's 1982 fisheries studies were compared with Dames & Moore 1982 data. For juvenile chinook salmon, similar timing of peak catches were noted in both 1982 studies. Both 1982 studies identified two different year classes of juvenile coho salmon. The Puyallup Nation fisheries data in 1982 indicated low catches of juvenile pink salmon at Milwaukee and Middle waterways.

The Puyallup Nation 1983 study efforts are designed to complement Port of Tacoma beach seine studies being performed by Fisheries Research Institute (University of Washington). No 1983 data were revealed at the time of this writing.

APPENDIX B

RATINGS OF IMPACT SIGNIFICANCE*

The significance of all potential impacts considered in this study was evaluated using a rating scale. Five hierarchic categories are included in the (ordinal) significance rating scale: severe, considerable, moderate, minimal, and inconsequential. As a notational convenience, these significance levels are denoted by the letter codes S, C, Mod, Min, and I.

As discussed in the Chapter 2, Evaluation of Methodology, each potential impact was evaluated on four characteristics: magnitude, extent, duration, and probability of occurrence. This appendix documents how these four characteristics were combined to produce impact significance ratings. Since each of the four impact characteristics has three possible levels, there are a total of 81 (3^4) possible combinations. These 81 combinations are identified by a sequence of 4 numbers representing evaluations (in order) of an impact's magnitude, extent, duration, and probability according to the following assignments:

Magnitude:	1	Major	Duration:	1	Long Term
	2	Moderate		2	Limited or Intermittent
	3	Minor		3	Short Term
Extent:	1	Large	Probability:	1	Probable
	2	Localized		2	Possible
	3	Limited		3	Unlikely

Thus, for example, the sequence 2311 is used to represent an impact of moderate magnitude, limited extent, long-term duration, and whose occurrence is probable. Criteria used in assigning levels to each impact characteristic for each resource area are provided in Appendix C.

The significance ratings are presented in the four tables in this appendix. Each table provides complete information on significance ratings for all 81 possible combinations of magnitude, extent, duration, and probability. For each table, however, the influence of varying only one of the four impact characteristics while holding the values of the other three characteristics constant is shown. These analyses of magnitude (Table B-1), extent (Table B-2), duration (Table B-3), and probability (Table B-4), while presenting redundant information, allow direct comparisons of the "importance" of each of the four impact characteristics in determining the overall significance ratings. Inspection of the four tables shows that significance ratings are affected independently by each characteristic, and therefore none of them is unimportant. However, since the significance ratings vary more frequently for independent variations in magnitude and probability, these two characteristics are shown to exert a greater influence on the significance ratings than extent and duration.

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*The term "significance," as used herein, is intended only to convey a sense of relative importance among impacts, and is not intended to convey the meaning of "significant" as defined in the context of the NEPA EIS in 40 CFR §1508.27.

TABLE B-1

RATINGS OF IMPACT SIGNIFICANCE: ANALYSIS BY MAGNITUDE

( )111: S, C, Mod	( )211: S, C, Mod	( )311: S, Mod, Min
( )112: C, Mod, Min	( )212: C, Mod, Min	( )312: C, Mod, Min
( )113: M, Min, I	( )213: Mod, Min, I	( )313: Mod, Min, I
( )121: S, C, Mod	( )221: S, Mod, Min	( )321: S, Min, I
( )122: C, Mod, Min	( )222: C, Mod, Min	( )322: Mod, Min, I
( )123: Min, I, I	( )223: Min, I, I	( )323: Min, I, I
( )131: S, C, Min	( )231: S, Mod, Min	( )331: S, Mod, I
( )132: C, Mod, Min	( )232: Mod, Min, I	( )332: Mod, Min, I
( )133: Min, I, I	( )233: Min, I, I	( )333: Min, I, I

Note: ( )111: S, C, Mod represents significance ratings for 1111, 2111, and 3111 as S, C, and Mod, respectively.

Significance Ratings:

S	Severe
C	Considerable
Mod	Moderate
Min	Minimal
I	Inconsequential

TABLE B-2

RATINGS OF IMPACT SIGNIFICANCE: ANALYSIS BY EXTENT

1( )11: S, S, S	2( )11: C, C, Mod	3( )11: Mod, Mod, Min
1( )12: C, C, C	2( )12: Mod, Mod, Mod	3( )12: Min, Min, Min
1( )13: Mod, Mod, Mod	2( )13: Min, Min, Min	3( )13: I, I, I
1( )21: S, S, S	2( )21: C, Mod, Mod	3( )21: Mod, Min, I
1( )22: C, C, Mod	2( )22: Mod, Mod, Min	3( )22: Min, Min, I
1( )23: Min, Min, Min	2( )23: I, I, I	3( )23: I, I, I
1( )31: S, S, S	2( )31: C, Mod, Mod	3( )31: Min, Min, I
1( )32: C, Mod, Mod	2( )32: Mod, Min, Min	3( )32: Min, I, I
1( )33: Min, Min, Min	2( )33: I, I, I	3( )33: I, I, I

Note: 1( )11: S, S, S represents significance ratings for 1111, 1211, and 1311 as S, S, and S, respectively.

Significance Ratings:

S	Severe
C	Considerable
Mod	Moderate
Min	Minimal
I	Inconsequential

TABLE B-3

RATINGS OF IMPACT SIGNIFICANCE: ANALYSIS BY DURATION

11( )1:	S, S, S	21( )1:	C, C, C	31( )1:	Mod, Mod, Min
11( )2:	C, C, C	21( )2:	M, M, M	31( )2:	Min, Min, Min
11( )3:	Mod, Min, Min	21( )3:	Min, I, I	31( )2:	I, I, I
12( )1:	S, S, S	22( )1:	C, Mod, Mod	32( )1:	Mod, Min, Min
12( )2:	C, C, Mod	22( )2:	Mod, Mod, Min	32( )2:	Min, Min, I
12( )3:	Mod, Min, Min	22( )3:	Min, I, I	32( )2:	I, I, I
13( )1:	S, S, S	23( )1:	M, M, M	33( )1:	Min, I, I
13( )2:	C, Mod, Mod	23( )2:	Mod, Min, Min	33( )2:	Min, I, I
13( )3:	Mod, Min, Min	23( )3:	Min, I, I	33( )2:	I, I, I

Note: 11( )1: S, S, S, represents significance ratings for 1111, 1121, and 1131 as S, S, and S, respectively.

Significance Ratings:

S	Severe
C	Considerable
Mod	Moderate
Min	Minimal
I	Inconsequential

TABLE B-4

RATINGS OF IMPACT SIGNIFICANCE: ANALYSIS BY PROBABILITY

111( ):	S, C, Mod	211( ):	C, Mod, Min	311( ):	Mon, Min, I
112( ):	S, C, Min	212( ):	C, Mod, I	312( ):	Mod, Min, I
113( ):	S, C, Min	213( ):	C, Mod, I	313( ):	Min, Min, I
121( ):	S, C, Mod	221( ):	C, Mod, Min	321( ):	Mod, Min, I
122( ):	S, C, Min	222( ):	Mod, Min, I	322( ):	Min, Min, I
123( ):	S, Mod, Min	223( ):	Mod, Min, I	323( ):	Min, I, I
131( ):	S, C, Mod	231( ):	Mod, Mod, Min	331( ):	Min, Min, I
132( ):	S, Mod, Min	232( ):	Mod, Min, I	332( ):	I, I, I
133( ):	S, Mod, Min	233( ):	Mod, Min, I	333( ):	I, I, I

Note: 111( ): S, C, Mod represents significance ratings for 1111, 1112, and 1113 as S, C, Mod, respectively.

Significance Ratings:

S	Severe
C	Considerable
Mod	Moderate
Min	Minimal
I	Inconsequential

APPENDIX C

METHODOLOGY BY RESOURCE AREA

INTRODUCTION

This section describes how the assessment methodology (discussed in Section 2) was applied to each resource area.

The level, or severity, of impact was assessed using the four parameters of environmental impact: magnitude (how much), extent (geographic incidence), duration, and probability of occurrence. The evaluation criteria for extent, duration, and probability were the same for all resource areas, with few exceptions. These criteria are listed in Table C-1 and are not repeated in the methodology sections that follow. Where different criteria were necessary they are described within the particular resource area discussion. Criteria used in assessing magnitude of impacts varied by resource area. These criteria are discussed in each methodology section.

Assessments were based on previously published data, particularly the Commencment Bay Study (Dames & Moore 1981). When no data were available, assumptions were made as to existing conditions. These assumptions are stated for each resource area. Any assumptions made as to the meaning of terms or exclusions are also clearly stated.

FISH AND INVERTEBRATES

The assessment of impacts generated by study area projects on fish and invertebrates considered the following factors:

- Physical and chemical environment of the area.
- Likely or demonstrable present use of area by biota; e.g., relative importance based on COBS data. Special attention was paid to use by juvenile salmonids.
- Degree of disturbance during construction either directly or as a result of water quality, noise, etc.
- Degree of long-term modification of habitat that will persist through project life; e.g., net area dredged or filled, shoreline lost or modified, extent of overwater structures. Again special attention was given to shallow water rearing habitat for juvenile salmonids with somewhat lesser importance placed on other fish and invertebrates (except those that are predominant food items for salmonids).
- Nature of impacts related to the operational function of the facility; for example, effluents, spillage, and vessel movements.
- Area of the bottom affected and the net shoreline loss for operational impacts.

TABLE C-1

CRITERIA FOR ASSESSING LEVELS OF IMPACT

Parameter	Magnitude		
Level of Impact	Large	Localized	Limited
Evaluation Criteria	See individual resource area discussions.		

Parameter	Extent[a]		
Level of Impact	Large	Localized	Limited
Evaluation Criteria	Effect extends beyond immediate vicinity or to a large area (e.g., downstream or to the region) or affects many people.	Effect extends to immediate vicinity (i.e., to areas adjacent to or in sight of site).	Effect does not extend beyond site and property already under control of sponsor, or affects only a few people.

Parameter	Duration		
Level of Impact	Long-Term	Intermittent	Short-Term
Evaluation Criteria	Effect will occur for 1 year or longer.	Effect will occur for 6 months to 1 year or on an intermittent basis.	Effect will occur for less than 6 months.

Parameter	Probability		
Level of Impact	Probable	Possible	Unlikely
Evaluation Criteria	Effect will likely occur.	Effect may occur but likelihood is uncertain or related to circumstances that could foster the effect but which are unpredictable.	Little or no likelihood that the effect will occur.

(a) See resource data discussion for criteria for Noise, Aesthetics.

The criteria for extent, duration, and probability described in Table C-1 were used in this assessment. The extent of loss of salmonid habitat was considered "localized" because of the likely increase in use and importance of adjacent areas. Criteria used to assess magnitude are stated below:

Magnitude		
Major	Moderate	Minor
Depletes or substantially modifies, degrades, or destroys a pristine, sensitive, or nonrenewable resource (e.g., threatened or endangered species; critical habitat) alternatively, affects large area (e.g., 3 acres or more) of less valuable habitat.	Partially modifies degrades, destroys, or consumes average or already degraded resources, or slightly degrades pristine resources; affects moderate area (e.g., 1 to 3 acres).	Slightly modifies, degrades, destroys, or consumes resources already affected by cultural practice; alternatively, affects relatively small area (e.g., less than an acre).

Direct loss of existing biota was assumed to be a construction impact. Recurrent (permanent) denial of use of the affected area (e.g., by migratory species) was assumed to be an operational impact. Use of the modified habitat by biota (e.g., colonization of dredged or filled areas) was likewise assumed an operational impact. Mitigation actions that could be incorporated into initial project design were considered as part of the construction phase of the project; those that could be added to the project later or that could be applied offsite are considered as part of operation of the project.

Assessment of the degree to which project development will affect the treaty fishing rights of the Puyallup Tribe and other Native Americans using the waters of Commencement Bay and the greater Puget Sound was not conducted, since such an assessment is beyond the scope of the COBS II studies. However, it can be assumed that any project that adversely affects fish and invertebrates in the study area will to some degree affect the value of the commercial and subsistence fishing by the Puyallup Tribe and other Native Americans in the COBS study area and adjacent waters.

BIRDS

The assumption used to evaluate impacts on birds for each proposed project in the study area were as follows:

- Areas used by birds for nesting, feeding, and resting as defined in COBS (Blaylock 1981) were assumed to be important or sensitive resources.

- Proposed projects that would cause loss of known nesting sites were always assumed to be of major magnitude.

Proposed projects causing the direct removal of habitat with known bird use were evaluated by looking at the type of bird use at the site, other areas supporting similar use, and the seasonality of a site's importance. If a proposed project affected the only known nesting, feeding, or resting habitat for a particular species or group of species the impact resulted in higher magnitude rating than if other areas with similar bird use existed elsewhere.

Loss of habitat versus temporary disturbance was also compared. Projects that affected birds by short-term disturbance during construction resulted in lower significance levels than projects that caused permanent habitat loss. Areas used primarily by migratory birds on a seasonal basis were considered to be as important as areas used year round by resident birds based on the assumption that migratory species cannot find other suitable habitat outside the study area.

The criteria outlined in Table C-1 for extent, duration, and probability were used in this assessment. The criteria for magnitude are given below:

Magnitude		
Major	Moderate	Minor
Depletes, modifies, degrades, or removes important or sensitive resources.	Partially modifies, degrades, or removes important or sensitive resources.	Slightly modifies degrades, or removes resources already affected by man's activities.
Removes bird nesting habitat.	Similar habitat types available elsewhere in the study area.	Produces short-term disturbances during construction.
No similar habitat available in study area.	Habitat used seasonally.	

WETLANDS

The assumptions used to evaluate impacts on wetlands for each proposed project in the study area were as follows:

- All wetlands identified and mapped in COBS I (Boule and Dybdahl 1981) were assumed to be nonrenewable resources.
- Intertidal mud- and sandflats were assumed to be nonrenewable resources.
- Small areas of intertidal shoreline bordered by industrial uses or modified from a natural state were assumed to be previously degraded resources.

If a proposed project caused the loss of existing wetland acreage, a comparison was made between the type and extent of wetland lost versus the amount of similar habitat remaining. Freshwater wetlands are rarer than intertidal wetlands in the study area; therefore, loss of the former resulted in a relatively higher level of magnitude in most cases. The nature of the biotic community inhabiting intertidal wetlands was assessed to determine the relative importance of an intertidal wetland. Areas that were known to support juvenile salmonid rearing or bird use were judged to be important to the overall productivity of the natural environment of the study area.

Future operations at the site of projects that did not directly affect wetlands (i.e., caused no loss of wetland acreage) were also examined, as well as the potential for operation activities to affect adjacent wetland areas.

The standard criteria for extent, duration, and probability (Table C-1) were used in this assessment of wetlands. The criteria developed for assessing magnitude are listed below:

Magnitude		
Major	Moderate	Minor
Depletes, modifies, degrades, or removes a nonrenewable resource.	Partially modifies, degrades, or removes a previously degraded resource.	Slightly modifies degrades, or removes resources currently affected by man's activities.
Mitigation by replacement in kind probably not feasible.	Mitigation by replacement in kind probably feasible.	Mitigation probably not an issue or can be accomplished through acceptable construction practices.
Removes habitat supporting known juvenile salmonid rearing and bird use.	Removes habitat of questionable or unknown importance to other biota in the study area.	Habitat not known to be important to other biota in the study area.

The loss or alteration of existing wetland resources was assessed as a construction impact, and the long-term denial of use of the affected area was assessed as an operational impact.

WATER QUALITY AND SEDIMENTS

The assessment of impacts from proposed projects on water quality and sediments considered the following factors:

- Size of the area to be disturbed (dredged, filled, piles driven, etc.).

- Anticipated outputs (effluents, spillage, etc.) from project operation.

- Potential flushing/circulation at and adjacent to the project site in the short and long term.

- Known water quality at and adjacent to the project site.

- Bioassays of sediments and sediment quality at and adjacent to the project site.

Criteria used in assessing impacts for extent, duration, and probability conform to those listed in Table C-1. Criteria used in assessing the magnitude of impacts are given below.

Certain assumptions were made in evaluating potential impacts. A sparse water/sediment quality data base, the U.S. Environmental Protection Agency (EPA) Water Quality Criteria (45 Fed. Reg. 79318 [1980]), and past experience with the study area were used to determine whether a project area was in a highly or moderately contaminated environment or a relatively uncontaminated environment. Biota to be influenced by water quality changes were assumed assessed in the Fish and Invertebrates section. Areas with water quality parameters exceeding EPA criteria were called highly contaminated. The EPA criteria were used although biota are present in selected locations that exceed water quality parameters.

Additional assumptions are listed below:

- No direct impacts of water quality to man were assessed (e.g., fumes/fluids with a direct intake to man).

- Sediments are as toxic as shown by the worst case in close proximity to the project under evaluation (i.e., usually included Swartz et al. 1982 results).

- Water quality is represented by the closest station(s) with available data, even though the system is more dynamic than this and some data are 2 to 3 years old.

- Sediments were involved in evaluations only where the project would disturb them to change water quality in either construction or operation.

- Fill was assumed to be clean upland material unless otherwise stated.

- New projects in new sites are potentially more damaging to water quality than small additions to existing facilities.

- Additions to existing facilities were excluded as major water quality impacts.

Magnitude[a]		
Major	Moderate	Minor
Large- or medium-scale project in a highly contaminated water and/or sediment quality environment.	Large-scale project in a good or uncontaminated water or sediment quality environment if fuels or other contaminants could be released during operation.	Large-scale project in a good or uncontaminated water or sediment quality environment with no potential for release of fuels or other contaminants during operation.
Large-scale project in a moderately contaminated water and/or sediment quality environment.	Medium-scale project in a moderately contaminated water or sediment quality environment.	Medium- or small-scale project in a good or uncontaminated water or sediment quality environment.
	Small-scale project in a highly contaminated water or sediment quality environment.	Small-scale project in a moderately contaminated water or sediment quality environment with no potential for release of fuels or other contaminants during operation.
	Small-scale project in a moderately contaminated water or sediment quality environment if fuels or other contaminants could be released during operation.	

(a) Large-scale project: occurs over multiple acres.
Medium-scale project: occurs on approximately 1 acre.
Small-scale project: occurs on much less than 1 acre.

NOISE

The assessment of construction and operational sound increases generated by study area projects was based upon the estimated intensity, length of time, and area over which these increases would occur. Assessment criteria for magnitude and extent are described below:

Magnitude[a]		
Large	Moderate	Minor
Effect occurs as the result of large- or medium-scale construction activities heard by many sensitive receptors.	Effect occurs as the result of large-scale construction activities heard by many sensitive receptors.	Effect occurs as the result of moderate- and minor-scale construction activities heard by few sensitive receptors.
Effect occurs as the result of large-scale construction activities heard by moderate numbers of sensitive receptors.	Effect occurs as the result of medium-scale construction activities heard by moderate numbers of sensitive receptors.	Effect occurs as the result of small-scale construction activities heard by moderate numbers of sensitive receptors.
Operation will cause substantial increase in noise.	Effect occurs as the result of small-scale construction activities heard by many sensitive receptors. Operation will cause moderate increase in noise.	Operation will cause slight increase in noise.

Extent		
Large	Localized	Limited
Effect extends to adjacent properties at a distance greater than 1,000 feet.	Effect extends only to adjacent properties within approximately 500 to 1,000 feet.	Effect occurs within the property limits.

(a) Large-scale construction activities = large numbers of piles driven; 100,000 cubic yards or more dredged or filled.
Medium-scale construction activities = moderate numbers of piles driven; 25,000-100,000 cubic yards or more dredged or filled.
Small-scale construction activities = few piles driven; less than 25,000 cubic yards or more dredged or filled.
Sensitive receptors defined in Cass 1981.

The criteria for duration and probability conform with the descriptions stated in Table C-1. Probability in all cases was considered probable. Previously published reports were used to determine existing conditions and to define acoustical terminology as used herein (Cass 1981; Dames & Moore 1978).

Construction sounds associated with area construction will vary with time and location and, therefore, cannot be described in simple terms. The methodology used for their analysis considers the acoustic energy emitted by the equipment involved during the various construction phases, analyzing both the magnitude of the emitted sound and the exposure duration. This method, as outlined in the U.S. Environmental Protection Agency (EPA) report Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances (U.S. EPA, Office of Noise Abatement and Control 1971), allocates construction efforts among the various construction phases in determining the equivalent sound level at a prescribed distance from the center of activities. Because various phases or activities would occur simultaneously, the sound contribution of typical equipment has been grouped together to determine a range in equivalent sound levels for construction.

Typical construction activities and their estimated equivalent sound levels at 50 feet (15 meters) from the center of typical activities are listed in Table C-2. Estimates of typical equipment sound contributions and usage factors (representing the time equipment is operating in its noisiest mode) are based on published studies by the U.S. Army Corps of Engineers, Construction Engineering Research Laboratory (1977), the U.S. Environmental Protection Agency, Office of Noise Abatement and Control (1971 and 1975), and Dames & Moore's files.

The impact of construction noise on the ambient sound environment can be determined by extrapolating the noise from construction to neighboring areas and reviewing the resulting construction ambient sound level with applicable state and local noise standards. The contribution of construction noise on the surrounding developments is extrapolated by assuming hemispherical sound radiation. The assumption of hemispherical sound radiation does not include the effects of sound attenuation due to foliage, air and ground absorption, and the barrier effects of topography, and is therefore conservative.

Washington Administrative Code (WAC) Chapter 173-60 (1980) specifies maximum permissible environmental noise levels for designated land uses. The environmental designation for noise abatement (EDNA) is based on typical land uses, taking into consideration the present, future, and historical usage, as well as the usage of adjacent lands. The EDNA classifications for industrial areas is Class C. For a Class C source and receiver, the maximum daytime equivalent sound level is 70 dB, while the nighttime sound level limit is 60 dB. Sounds originating from construction activities are exempt from the provisions of WAC 173-60-040, except insofar as such provisions relate to the reception of noise in Class A EDNAs (residential and noise-sensitive recreational areas) between the hours of 10:00 p.m. and 7:00 a.m. Since receiving properties in the study area are generally industrial, all construction activities would be exempt from the provisions of WAC 173-60-040. The exceptions

TABLE C-2

TYPICAL CONSTRUCTION SOUND LEVELS AND ZONES OF POTENTIAL NOISE IMPACT

Construction Activity	Equivalent Sound Level (dB) at 50 feet from the Center of Construction Activities	Potential Zone (feet) of Noise Impact Within Which L_{dn} >70 dB[a]
Dredging and site filling	88-93	560 - 1,000
Dredging with trucking of spoils	88-93	560 - 1,000
Dredging with barging of spoils	86-93	450 - 1,000
Piledriving	87-97	500 - 1,500
Building demolition	84-87	350 - 500
Building erection (industrial)	72-85	90 - 400
Bulkhead construction with filling	89-94	740 - 1,100
Road construction	78-91	180 - 800
Grading, paving, and draining	84-90	350 - 700
Containment dike construction	78-93	180 - 1,000
Riprap placement	88-90	560 - 700
Upland fill	93	1,000

(a) Within this zone noise levels are "normally or clearly unacceptable" for residential and sensitive receptors. Noise levels for industrial receptors range from "conditionally acceptable" to "clearly unacceptable." Categories discussed in Dames & Moore (1978).

Source: U.S. Army, Corps of Engineers, Construction Engineering Research Laboratory 1977; U.S. EPA, Office of Noise Abatement and Control 1971, 1975; Dames & Moore files.

would be residences below Marine View Drive, hospitals and hotels within the City of Tacoma, and Fireman's Park.

Land use/noise compatibility guidelines for industrial areas as indicated in the City of Tacoma's Coastal Zone Management Study (Dames & Moore 1978) call for a maximum day-night sound level of 70-75 dB to be "normally acceptable." Under these conditions, potential zones in which day-night sound levels could exceed 70 dB during construction activities are indicated in Table C-2. Outdoor receptors within this prescribed zone (distance) may be temporarily affected by construction noise depending on the exact number and types of construction equipment and their relative position in regard to area construction. These distances, shown in Table C-2, are based on a typical daytime construction schedule not exceeding 10 hours per day. For longer periods of construction, the potential impact zone may widen. Residential receptors, hospitals, libraries, etc., and neighborhood parks within this distance zone would find these noise levels "clearly" or "normally unacceptable" according to the guidelines.

The data in Table C-2 and the land use/noise compatibility guidelines were used in assessing the magnitude and extent of impacts resulting from noise increases. Although noise increases resulting from construction activities would be exempt from WAC standards within the industrial area, sound levels may still be unacceptable to individuals working within a zone around the activity. Therefore, violation of WAC standards was not used to determine the magnitude or noise level impacts caused by construction activities. In this analysis the worst case construction sound level was assumed to occur over the entire construction period. Operational noise levels of projects where efficiency has been improved or capacity has only been slightly increased within the industrial area have been assumed to have minor noise level increases.

AESTHETICS

The methodology used in this assessment does not attempt to assess the visual quality of the study area in terms of relative attractiveness or as being either "visually pleasing" or "not visually pleasing," since the quality of a view is subject to viewer interpretation. However, areas sensitive to visual change are identified.

Visual changes caused be even the largest projects within the industrial area will be proportional with existing buildings and will be similar to existing activities. Views will be substantially unaltered and visual change will be consistent with viewer expectation of the area. Therefore, no assessment was made for individual projects within the industrial area because no adverse impacts are expected to occur.

The north shore of Commencement Bay and City Waterway was evaluated separately from the industrial area because of differing baseline conditions and viewer expectations for the area (Van Dyke 1981). Projects along City Waterway will be constructed in an area in transition from industrial use to water-oriented urban development use. Development is subject to policies set forth in the City Waterway Policy Plan (Tacoma, Planning Department 1974) that are directed in part at improving

the visual character of the waterway in order to attract large numbers of viewers. These policies prescribe "viewer expectation" i the assessment for the City Waterway area.

Assessment criteria for magnitude and extent are described below. The criteria for duration and probability conform with the descriptions stated in Table C-1.

Magnitude		
Large	Moderate	Minor
Effect produces strong contrasts (in form, line, color, and texture) with existing conditions and/or viewer expectations.	Effect produces moderate contrasts (in form, line, color, and texture) with existing conditions and/or viewer expectations.	Effect produces minor contrasts (in form, line, color, and texture) with existing conditions and/or viewer expectations.
Extent[a,b]		
Large	Localized	Limited
Effect occurs within many people's foreground or middlegro und views.	Effect occurs within many people's middle-ground views and a moderate number of people's middleground or distant views.	Effect occurs within many people's middle-ground views and a moderate number of people's distant views.
	Effect occurs within many people's distant views and a moderate number of people's foreground or middle-ground views.	Effect occurs within a few people's fore-ground, middleground, or distant views.

(a) Views are approximated as:
foreground = less than 500 feet.
middleground = 500 to 1,000 feet.
distant = over 1,000 feet.

(b) Numbers of people found within the study area are approximated as:
many = Tacoma central business district;
moderate = motorists along Marine View Drive; property owners overlooking the study area;
few = home owners along the north shore of Commencement Bay.

RECREATION

Eight major existing and potential recreational amenities or activities were identified as having recreational value in the study area: beachcombing, pleasure boating, fishing, bird watching, public access to waterfront facilities, scenic viewpoints, scenic automobile routes, and scenic bicycle routes (Johnston 1981; Blaylock 1981, 1983; Tacoma Planning Department 1974, 1981; Tacoma Planning Commission 1978; Boule and Dybdahl 1981). Where documentation of recreational use could not be found, a project area was considered to have recreational potential in the categories below if it had the following associated characteristics.

- Beachcombing - A natural or relatively unmodified beach or shoreline exists with accessibility to the public.
- Pleasure boating - Recreational boating opportunities exist along with facilities (marina, public wharf, boat launch, etc.) offering access to open marine waters of the region.
- Fishing - Fishing opportunity exists from the shore, beach, pier, etc. located in public use areas.
- Bird watching - Significant opportunity for bird watching exists (in areas prescribed by Blaylock [1983]).
- Public access to waterfront facilities - The area is a designated public access area (e.g., park, beach, boardwalk, marina, wharf) or a publically owned area with natural or urban amenities.
- Scenic auto route - The route is a designated scenic highway.
- Scenic viewpoint - The viewpoint is a designated view area.
- Bicycle route - A designated route occurs adjacent to or through the project.

Impacts occurred when recreational activity was disrupted or when the opportunity for recreational activity was reduced or eliminated as a result of a project. The magnitude of a project's recreational impact is directly dependent upon the number of activities disrupted or lost or the degree to which a given activity is disrupted. The criteria used for assessing magnitude are described below. All other criteria conform with Table C-1.

Magnitude		
Major	Moderate	Minor
Effect substantially reduces the number or scope of existing recreational opportunities.	Effect partially reduces the number or scope of existing opportunities.	Effect slightly reduces the number or scope of existing recreational opportunities.

The following assumptions were made prior to assessment:

- o Reductions in pleasure boating opportunities due to project-generated increases in potential conflicts with other vessels will be evaluated as navigational hazards in the Water Use section.
- o Scenic "views" will be evaluated in the Aesthetics section.
- o Few or no recreational opportunities exist in the port industrial area due to heavy industrial activity and substantial historic modification of shorelines.

HISTORICAL/CULTURAL/ARCHAEOLOGICAL

The study area was screened for conflicts with historical, cultural, or archaeological resources. No conflicts were found for most projects; in these cases, no further assessment was made. Criteria used in evaluating the remaining projects are the same as those in Table C-1 except for magnitude, which is described in the following table.

Magnitude		
Major	Moderate	Minor
Substantially modifies, degrades, or destroys a largely unaltered designated historical, cultural, or archaeological resource.	Partially modifies, degrades, or destroys an already degraded designated historical, cultural, or archaeological resource, or slightly degrades a largely unaltered resource.	Slightly modifies, degrades, or destroys an already degraded designated historical, cultural, or archaeological resource.

As indicated in discussions of historical land and water use in Johnston (1981), the Commencement Bay study area in general was extensively used by the Puyallup Tribe as a traditional fishing and hunting ground. Certain sites were also used as village sites and burial grounds. Other areas, principally located along City Waterway, were used by early settlers as cabin sites and for other uses. While it is unlikely that any of the projects identified for development in this study would impose serious impacts on known archaeological or historical resources, any project development in the Commencement Bay Study area has the potential for affecting unrecognized sites or artifacts.

This potential increases for any project involving the reconfiguration of waterways or lands that entail the disturbance of previously undisturbed or relatively undisturbed substrate. Excavation, dredging, and other activities associated with several projects, including Project Nos. 1, 7, 19, 23, 24, 33, 35, and 36 have the greatest potential for uncovering important archaeolocial and historic resources, due to their location with respect to known resource sites or the relatively undisturbed

nature of underlying substrate. However, it should be reemphasized that archaeological resources may be located virtually anywhere within the port industrial and City Waterway areas.

Some potential for finding historical or archaeological resources exists at virtually all study area sites. The Corps has the option, via its permit regulations, of requiring an applicant to terminate construction temporarily and conduct evaluations as necessary to determine the vertical and horizontal distribution and significance of resources uncovered during construction. These investigations should be performed by a qualified archaeologist retained by the Corps, state, applicant, or the Puyallup Tribe. (See mitigation section on filling and dredging activities in Chapter 5).

Historic preservation along City Waterway already includes the Old City Hall and Union Depot/Warehouse Historic Districts, Old City Hall and Union Station, and the Tacoma Totem Pole in Firemen's Park (Tacoma, Department of Planning and Community Development 1979). The Municipal Dock, a firehouse, a warehouse, and other buildings along the waterway have potential for historic preservation (Sias 1983). The only projects that will alter or remove structures are Project No. 33 and No. 35. The final design of Project No. 33 has not yet been determined. Project No. 35 does not affect any property with historic potential (Sias 1983).

It is assumed no projects within the remainder of the industrial area will affect historical properties.

LAND AND WATER USES

The assessment of land and water use impacts generated by study area projects was driven by a number of assumptions and assessment criteria. For the purpose of the land and water use impact assessments, the following major assumptions were applied:

- Construction impacts included only those effects directly attributable to construction activities (i.e., temporary conversion of lands for staging of construction-related materials and equipment; use of adjacent waters and approach channels for delivery of construction materials and use by construction-related vessels; increased overland traffic (rail and vehicular) to deliver construction materials and workers to the site).

- Operation impacts included all other long-term project-associated impacts, permanent changes in land and water use, and intensity to support project operation. The level of project consistency with existing land use or coastal zone management plans and policies also was considered to be an operational impact.

- Vessel traffic volumes generated by specific nonmarine projects were based on sponsor estimates or estimates of vessel use at comparable facilities.

- Peak vessel volumes for marinas were estimated as follows: Annual: 1 vessel trip per moorage per week; Daily: 1 vessel trip per moorage; Hour: 15 percent of marina capacity. These use estimates were derived from accepted estimates in U.S. Army Corps of Engineers, Seattle District (1983).

Specific criteria were developed to assess the magnitude of land and water use impacts to more accurately reflect the levels of associated impacts. These criteria, which apply both to construction and operation impacts, are described below.

Project generation of vehicular traffic (automobiles and trucks) was estimated on the basis of comparisons with traffic generated by similar projects. Estimates of traffic volumes generated by marine operations were derived using data on marina impacts by the U.S. Army Corps of Engineers, Seattle District (1983).*

The criteria for extent, duration, and probability described in Table C-1 were combined with the magnitude assessment to yield the land and water use impact significance rating for a given project. Only limited additional land and water use assumptions were applied specifically within these criteria. One such assumption is noteworthy. It was assumed, for both land and water use, that existing regional land and water transportation systems are sufficiently well developed and have sufficient excess capacity to accommodate vehicular, rail, and vessel traffic. Therefore, the extent of land and water use impacts of each individual project was assessed to be either localized or limited. No such assumption was made when assessing the cumulative impacts of all projects in a given subarea or in the study area as a whole.

*Marina-induced traffic volumes were estimated as follows:

Average daily traffic (ADT):	1 vehicle trip per moorage
Peak daily traffic (summer weekend):	3 vehicles per moorage
Peak hour traffic (summer weekend):	1/2 vehicle per moorage.

Magnitude - Land Use		
Major	Moderate	Minor
Converts land from low-intensity, undeveloped lands with recognizable natural amenities to high-intensity urban or industrial use.	Converts land to a use that is more or less intense than surrounding uses.	Converts land to a use that does not change the overall character of the area and is comparable in intensity to nearby uses.
Substantially increases or decreases land use intensity relative to adjacent uses (incompatable adjacent or proximate uses).	Is consistent with selected elements in land use plans, but remains generally consistent with development plans and policies.	Is fully consistent with land use plans and policies.
Is fully inconsistent with the spirit and intent of land use plans and policies.	Moderately depletes the surplus capacity of existing transportation systems from offsite vehicular and rail traffic.	Generates no substantial off-site impacts.
Substantially taxes or exceeds existing transportation systems, offsite vehicular, or rail traffic.		
Severely limits or eliminates future use of disposal sites through upland disposal of dredge spoils or excavation materials containing hazardous wastes.		

Magnitude - Water Use[a,b]		
Major	Moderate	Minor
Creates navigational safety hazard through: • substantial increases in vessel traffic; • generation of a major change in vessel mix (proportion of vessel types using adjacent waters); • introduction of recreational vessels into established vessel traffic lanes; and • redistribution of vessels from one area to another area already used by vessels (relocation of land uses, major fills).	Creates moderate navigational safety hazard through: • moderate increases in vessel traffic; • changes in vessel use characteristics (e.g., moderate increase in vessels of same general type, function, and size).	Imposes little or no navigational safety hazard through: • small or no increases in vessel traffic.
Is clearly inconsistent with land use and coastal zone management plan policies.	Is inconsistent with selected elements of land use and coastal zone management plans, but remains generally consistent with developmental plans and policies.	Is fully consistent with land use and coastal zone management plans and policies.

(a) Water use impacts pertain primarily to navigational and vessel-related impacts. Water quality and supply impacts were assessed under Water Quality.

(b) Vessel traffic increases generated by marine projects were defined as:
Substantial = average of: 3 or more large vessels (>200 feet) per week, 1 or more medium-size vessels (50-200 feet) per day, or more than 100 small vessels (<50 feet) per day.
Moderate = average of: 1 or 2 large vessels per week, 3 to 6 medium-size vessels per week, or 20 to 100 small vessels per peak day.
Small = average of: 1 large vessel per week, <3 medium-size vessels per week, or <20 small vessels per peak day.

APPENDIX D

PROJECT IMPACTS MATRIX

This appendix presents a summary matrix (Table D-1) giving information on the impact evaluations for 37 defined projects in the study area. For each project, evaluations were made separately for project construction and operation for a total of 10 physical, biological, and human environment resource areas. The summary matrix provides the evaluations of potential magnitude, extent, duration, and probability for each resource area and project, as well as the significance rating associated with these impacts characteristics levels. (For the definition of significance ratings and an explanation of the four number codes representing magnitude, extent, duration, and probability of impacts, see Appendix B.)

The summary matrix for project impacts (Table D-1) provides documentation of the evaluations made on this study. It also provides a format for comparisons of impact evaluations within a given project (e.g., which impact areas are rated highest in significance), as well as comparisons across projects and within a given impact assessment area (e.g., which projects are rated highest in significance for impacts to water quality). The projects are listed in Table D-1 in groups by subarea; the summary matrix is therefore also useful for summarizing the impact information used in the assessments of cumulative development impacts.

TABLE D-1

PROJECT IMPACT ASSESSMENTS

(Before using this table please see Section 2, Methodology and Appendix B, Ratings of Impact Significance)

Project Name	Fish/ Invertebrates		Birds		Wetlands		Water Quality/ Sediments		Noise		Aesthetics		Recreation		Historical/ Cultural/ Archaeological		Land Use		Navigation/ Water Use	
SUBAREA 1 - HYLEBOS WATERWAY																				
1. Hylebos Marina	1211[a] S	1211[b] S	2321 Mod.	3311 Min.	1221 S	1211 S	2222 Mod.	3311 Min.	1121 S	2311 Mod.	2221 Mod.	3211 Mod.	2321 Mod.	2311 Mod.	1322 Mod.	1313 Mod.	2221 Mod.	2211 C	3221 Mins.	1211 S
2. Sound Refining Pier Expansion	1321 S	1211 S	2121 C	2111 C	1221 S	1211 S	3222 Min.	2111 C	1221 S	3211 Mod.	—	—	3221 Min.	3311 Min.	—	—	2221 Mod.	1211 S	2221 Mod.	3211 Mod.
3. Johnson Dock	3332 I	3313 I	3333 I	3313 I	3331 I	3313 I	3332 I	3212 Min.	3131 Min.	3211 Mod.	—	—	—	—	—	—	3331 I	3311 Min.	3331 I	3311 Min.
4. Marine Technical Services Pier and Warehouses	2232 Min.	2212 Mod.	3333 I	3313 I	3333 I	3313 I	2232 Min.	3312 Min.	1131 S	3211 Mod.	—	—	—	—	—	—	3231 Min.	3211 Mod.	3231 Min.	3211 Mod.
5. Louisiana-Pacific Log Handling Facility	3231 Min.	3312 Min.	3333 I	3313 I	3333 I	3313 I	3333 I	3213 I	3331 I	3311 Min.	—	—	—	—	—	—	3331 I	3311 Min.	3332 I	3312 Min.
6. Hooker Chemical Modernization	—	—	3323 I	3333 I	—	3333 I	—	2233 I	3321 I	—	—	—	—	—	—	—	3321 I	—	3321 I	—
SUBAREA 2 - BLAIR WATERWAY																				
7. Blair Waterway Dredging and Bridge Replacement	1211 S	3311 Min.	2311 Mod.	3212 Min.	3333[c] I	3333[c] I	2212 Mod.	2212 Mod.	1211 S	3212 Min.	—	—	3311 Min.	3311 Min.	—	—	2212 Mod.	2212 Mod.	2211 C	2212 Mod.
8. TOTE Relocation and Finger Piers	3231 Min.	2312 Mod.	3233 I	3313 I	3233 I	3313 I	2132 Mod.	3211 Mod.	1131 S	3211 Mod.	—	—	—	—	—	—	2231 Mod.	3211 Mod.	3231 Min.	3211 Mod.
9. Pierce County Terminal Berth	3231 Min.	2312 Mod.	1332 Mod.	3212 Min.	1332 Mod.	3212 Min.	2232 Min.	3313 I	2231 Mod.	3211 Mod.	—	—	—	—	—	—	3231 Min.	3211 Mod.	3231 Min.	3211 Mod.
10. Pierce County Terminal Berth A and B Extension	3331 I	3312 Min.	3333 I	3313 I	3333 I	3313 I	3332 I	3312 Min.	2231 Mod.	3211 Mod.	—	—	—	—	—	—	2231 Mod.	3212 Min.	3231 Min.	3212 Min.

(a) Construction Impacts.
(b) Operation Impacts.
(c) Impacts imposed by Blair Waterway dredging will have inconsequential impacts on wetlands due to disposal of all dredged materials in Milwaukee Waterway (Project No. 21).

TABLE D-1

Project Name	Fish/ Invertebrates		Birds		Wetlands		Water Quality/ Sediments		Noise		Aesthetics		Recreation		Historical/ Cultural/ Archaeological		Land Use		Navigation/ Water Use	
11. Fife Storm Drain and Outfall	3331 I	3212 Min.	3333 I	3313 I	3331 I	3313 I	3233 I	3313 I	3231 Min.	3311 Min.	—	—	—	—	—	—	3331 I	3311 Min.	3231 Min.	3311 Min.
12. Concrete Technology Dredging	2222 Mod.	—	3323 I	—	3323 I	—	3222 Min.	—	3221 Min.	—	—	—	—	—	—	—	3321 I	—	3321 I	—
13. Port of Tacoma Terminal 4 Expansion and Dredging	2231 Mod.	2311 Mod.	3333 I	3313 I	2333 I	3313 I	2232 Min.	3313 I	2131 C	3211 Mod.	—	—	—	—	—	—	3331 I	3212 Min.	3331 I	3211 Mod.
14. Port of Tacoma Slip 2 Fill	2231 Mod.	2211 C	3333 I	3313 I	3331 I	3313 I	2232 Min.	3211 Mod.	1131 S	3211 Mod.	—	—	—	—	—	—	2231 Mod.	3311 Min.	2231 Mod.	3211 Mod.
15. Port of Tacoma Piers 1 and 2 Retirement, Slip 1 Fill	1211 S	1211 S	3211 Mod.	3312 Min.	3313 I	3313 I	2212 Mod.	3313 I	1111 S	3211 Mod.	—	—	—	—	—	—	3211 Mod.	3211 Mod.	2211 C	3311 Min.
16. Port of Tacoma Pier 5 Fill	2231 Mod.	3311 Min.	3333 I	3313 I	3333 I	3313 I	3232 I	3313 I	2231 Mod.	—	—	—	—	—	—	—	3231 Min.	2311 Mod.	2331 Mod.	2311 Mod.
SUBAREA 3 - SITCUM/ MILWAUKEE WATERWAYS																				
17. Port of Tacoma Berth D, Terminal 7 Extension	2221 Mod.	2211 C	2323 I	3313 I	3323 I	3212 Min.	2222 Mod.	3212 Min.	2221 Mod.	3211 Mod.	—	—	—	—	—	—	2211 Mod.	2311 Mod.	2221 Mod.	2311 Mod.
18. Sitcum Waterway Shoal Dredging	2231 Mod.	3311 Min.	3232 I	3313 I	3333 I	3313 I	3232 I	3212 Min.	2231 Mod.	—	—	—	—	—	—	—	3231 Min.	3311 Min.	3231 Min.	3211 Mod.
19. Sitcum Waterway Dredging	1221 S	3311 Min.	1121 S	2212 Mod.	1121 S	1212 C	1222 C	3212 Min.	2221 Mod.	—	—	—	—	—	1223 Min.	—	2122 Mod.	2212 Mod.	2221 Mod.	2211 C
20. Port of Tacoma Wharf	2231 Mod.	3211 Mod.	3333 I	3313 I	3333 I	3313 I	2232 Min.	3313 I	2231 Mod.	3211 Mod.	—	—	—	—	—	—	2231 Mod.	2211 C	2231 Mod.	2211 C

TABLE D-1

Project Name	Fish/ Invertebrates		Birds		Wetlands		Water Quality/ Sediments		Noise		Aesthetics		Recreation		Historical/ Cultural/ Archaeological		Land Use		Navigation/ Water Uses	
21. Milwaukee Waterway Fill	1221 S	1211 S	1221 S	1312 C	1221 S	1211 S	1221 S	2212 Mod.	2221 Mod.	3211 Mod.	___	___	3221 Mi...	3311 Min.	___	___	2121 C	3211 C	2321 Mod.	2211 C
22. Milwaukee Waterway Railroad Yard Paving	3232 I	3312 Min.	3232 I	3213 I	3333 I	3313 I	3332 I	3313 I	2331 Mod.	3311 Min.	___	___	___	___	___	___	3231 Min.	3311 Min.	3331 I	3311 Min.
23. Port of Tacoma Parcel 5 Fill	...	...	2231 Mod.	2312 Mod.	1121 S .	1111 S .	3231 Min.	3311 Min.	2231 C	3311 Min.	___	___	___	___	1332 Mod.	1312 C	2231 Mod.	2211 C	3331 I	3311 Min.
SUBAREA 5 - ST. PAUL/ MIDDLE WATERWAYS																				
24. Puyallup River Training Wall Maintenance	3223 I	___	3222 Min.	3313 I	3222 Min.	3313 I	3221 Min.	3313 I	2221 Mod.	___	2221 Mod.	___	3231 Min.	___	2321 Mod.	___	3223 I	___	3222 Min.	___
25. Pasport Mills Bulkhead	2231 Mod..	2311 Mod.	3333 I	3313 I	3332 I	3313 I	2332 Min.	3313 I	2231 Mod.	___	___	___	___	___	___	___	2231 Mod.	___	2232 Min.	___
26. Pacific Yacht Basin Repair Yard	3331 I	___	3333 I	3313 I	3333 I	3313 I	333: I	3212 Min.	2331 Mod.	3311 Min	___	___	___	___	___	___	3331 I	3211 Mod.	3331 I	3212 Min.
27. Foss Tug Float	3331 I	3311 Min.	3333 I	3313 I	3333 I	3313 I	3332 I	3313 I	2131 C	3211 Mod.	___	___	___	___	___	___	2331 Mod.	2312 Mod.	3331 I	2212 Mod.
SUBAREA 6 - CITY WATERWAY																				
28. Superior Oil Dock and Dredging	2231 Mod.	3312 Min.	3333 I	3313 I	3333 I	3313 I	1132 C	.	2131 C	___	3231 Min.	3211 Mod.	___	___	___	___	2231 Mod.	3211 Mod.	2231 Mod.	3211 Mod.
29. Globe Machine Ramp and Float	1231 Min.	3212 Min.	3333 I	3313 I	3333 I	3313 I	2232 Min.	3212 Min.	2131 C	3211 Mod.	___	___	___	___	___	___	3331 I	3311 Min.	3231 Min.	2212 Mod.
30. City Marina Expansion	2222 Mod	2211 C	3322 I	3313 I	3321 I	3312 Min.	2221 Mod.	2212 Mod.	2121 C	3211 Mod.	3221 Min.	3211 Mod.	___	___	___	___	2221 Mod.	2211 C	2221 Mod.	2211 C

TABLE D-1

Project Name	Fish/ Invertebrates		Birds		Wetlands		Water Quality/ Sediments		Noise		Aesthetics		Recreation		Historical/ Cultural/ Archaeological		Land Use		Navigation/ Water Use	
31. Dillingham Site Marina Expansion	3231 Min.	2212 Mod.	3333 I	3313 I	3332 I	3312 Min.	2231 Mod.	2312 Mod.	2131 C	3111 Mod.	3231 Min.	3211 Mod.	—	—	—	—	2331 Mod.	3211 Mod.	2331 Mod.	2211 C
32. Pick's Cove Covered Moorage	—	—	3333 I	3313 I	3333 I	3313 I	3333 I	3313 I	3231 Min.	—	3331 I	3311 Min.	—	—	—	—	3331 I	—	3331 I	—
33. Dock Street Connector	3221 Min.	3311 Min.	3321 I	3311 I	3321 I	3313 I	3222 Min.	2313 Min.	1121 S	3211 Mod.	2221 Mod.	3211 Mod.	—	—	2323 I	2313 Min.	2221 Mod.	3211 Mod.	3323 I	—
34. City Waterway Marina Expansion	3331 I	3212 Min.	3332 I	3313 I	3333 I	3313 I	2332 Min.	3212 Min.	2131 C	3211 Mod.	3231 Min.	3311 Min.	3231 Min.	3311 I	—	—	3231 Min.	3211 Mod.	2231 Mod.	3211 Mod.
35. Union Depot Redevelopment	—	—	3311 Min.	3312 Min.	3313 I	3313 I	3313 I	3313 I	1111 S	3311 Min.	3211 Mod.	3211 Mod.	3311 Min.	—	3311 Min.	2212 Mod.	2211 C	2211 C	—	3312 Min.
36. Tacoma Marina and Breakwater	3221 Min.	2212 Mod.	3323 I	3313 I	3323 I	3313 I	1122 C	2112 Mod.	1121 S	3211 Mod.	2221 Mod.	3211 Mod.	3221 Min.	3311 I	3221 Min.	3211 Mod.	2221 Mod.	2211 C	2221 Mod.	2211 C
37. Navigation Channel Realignment	3331 I	—	3333 I	3313 I	3333 I	3313 I	—	2112 Mod	—	—	—	—	—	—	—	—	—	2212 Mod.	—	2212 Mod.
Range of Significant Values (ignoring Ø)	S to I	S to I	S to I	C to I	S to I	S to I	S to I	C to I	S to I	Mod. to Min.	Mod. to I	Mod. to Min.	Mod. to I	Mod. to Min.	Mod. to I	C to Min.	C to I	S to Min.	C to 1	S to Min.
No. of S or C	6	7	3	2	5	5	4	1	18	0	0	0	0	0	0	1	2	8	2	7

END

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